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CONTENTS.

Editorials 659
Convention of the Electric Vehicle Association of America 662
Convention of Georgia N. E. L. A. Section 662
Convention Program of the Association of Edison Illuminating Companies 662
Conference of Governors of States 662
Pittsburgh Branch Meeting of the A. I. E. E. 665
Association Island Meeting of Lamp Manufacturers 666
Convention of Vermont Electrical Association 669
Convention of the Pennsylvania Electric Association 669
Wisconsin Commission News 677
New York Commission News 677
Current News and Notes 677
Georgia's Greatest Power Development 679
Lightning Arrester Installation of Pittsburgh Railway System. By Terrell Croft 683
An Industrial International Transmission System 686
The Electrification of a Gold Reduction Mill 687
Regenerative Control from a Commercial Viewpoint. By J. Gustaf V. Lang 689
Electrical Development in China. By L. R. Freeman 691
A 15-Ton Bottle Sign 693
Night Views in Oklahoma City 693
San Diego Lighting and Power Rates 693
The Electric Vehicle in Boston 693
Louisville Street-Lighting Campaign 693
Milwaukee Central-Station Statistics 694
The New York Edison Company Now Has Ninety-Five Electrics 694
A Creditable Load Chart 694
Testing Underground Cables 694
Electric Power Development at Denver 695
Competitive Illuminants 697
Ornamental Street Lighting 697
LETTERS TO THE EDITOR:
Calculation of Flywheels. By F. Hymans 698
Specialization in Electrical Engineering. By Charles L. Somers 699
Digest of Current Electrical Literature 699
New Apparatus and Appliances 704
Industrial and Commercial News 708
General News 711
Weekly Record of Electrical Patents 718

THE PENNSYLVANIA STATE CONVENTION.

The convention last week of the Pennsylvania Electric Association served to emphasize the fact that small central-station bodies, when representative, can handle to advantage matters of great importance. Considering the character of the papers generally, the meeting was not unlike other state meetings, save possibly in the matter of attendance, which exceeded 300. The feature of the convention which took lead of all others, not only on account of the questions involved, but also because of the extent and freedom of their discussion, was the report of the overhead-line committee. The association through its committee again voiced the needs of the smaller companies, and criticised the enactment of standards for distribution systems of a monetary value reckoned by the hundred millions without giving the minutest consideration to the legal as well as to the engineering questions involved. In the estimation of the state committee, the national overhead-line report in its present form involves the relinquishment by electric-light companies of certain of their legal rights, and in bringing forward and insisting on this consideration the assocation has rendered a distinct service to the industry. Honest differences of opinion may exist regarding what should and what should not be considered standard practice, and certainly the industry is old enough and large enough to have evolved something worth while standardizing; but the fact should always be kept well in mind that a standard adopted by the National Electric Light Association will legally be given great weight or at least accepted as evidence of proper usage, and used as a criterion by which all overhead line work throughout the country will be judged. Hence the need of caution in its adoption. If a company does not adopt this method of construction it might have difficulty in showing that its construction is as safe as that called for by the standards of the N. E. L. A., for certainly the burden of proof will be placed on its shoulders. All of the smaller companies, and they number over 5000, use overhead line work, and the consensus of opinion at the Pennsylvania meeting was that it would be unjust to commit these to any standard that might jeopardize investment or rights.

JULY ELECTRICAL EXPORTS.

The first figures of the new fiscal year are to hand in regard to electrical exports and are not devoid of interest. As our readers will probably remember, the gain for some time past in miscellaneous small electrical apparatus has been quite marked; while, on the other hand, the lesser activity in electrical machinery has been notable. For last July the statistics equalize the conditions. The export of electrical instruments in July, 1910, was not less than $839,059; the corresponding month this year it is down to

$707,214. On the contrary, the export of machinery in July, 1910, was $745,419, and this year it is $584,715. It is a long time since there was a setback in the development of this branch of trade, and presumably it was but temporary. The decline was very largely in Mexico, in both classes of goods; and now that that country appears to be settling down again and resuming work, a sharp upward turn may become noticeable. Otherwise the data do not seem to call for special comment.

EXPERIMENTAL DETERMINATION OF HYSTERETIC TORQUE.

It is an experimental fact, familiar to many who work with dynamo machinery, that when a direct-current machine is disconnected from its load or driver, as the case may be, and the rotor is turned by hand a very marked increase in resistance to rotation is encountered as soon as the field magnets are excited. Exciting or "killing" the field magnets commonly makes the difference between easy and hard turning of the rotor. It is well known that the extra quasi-frictional torque of the rotor on exciting the field magnet is due to magnetic hysteresis—that is, to the magnetic resistance which the iron of the rotor develops to reversal of its magnetic state. When a rotating magnetic field is developed in a machine, either by mechanical or alternating electromagnetic means, it is sometimes debated whether the hysteretic torque is constant at all slips. That is, there can, by general agreement, be no hysteretic torque when an iron rotor revolves in exact synchronism with a pure rotating magnetic field if the magnetic poles induced in the iron of the one element, say, the armature, are exactly in phase with the magnetic poles rotating in the other element or field. But suppose the armature begins to lag behind the field or to develop a slip? Now, of course, a hysteretic torque will be exerted between the elements tending to oppose the slip and to maintain synchronism. Will this torque be constant at all speeds and slips or will it increase up to a certain critical slip and thereafter diminish?

The above question, although it has been answered at various times in the past on theoretical grounds, is answered by experiment in an article of Herr Hermann Zipp printed in the *Elektrotechnische Zeitschrift* and recently referred to in the Digest. It is shown that the hysteretic torque is constant at all slips. At synchronism the hysteretic torque disappears, and above synchronism or at negative slip the hysteretic torque reappears reversed in direction and magnitude. At synchronism there is then a reversal or discontinuity in the torque, which reversal is not instantaneous—that is to say, in changing from a negative to a positive slip the discontinuity of hysteretic torque from backward to forward is not accompanied by sudden collapse. At synchronism as the phase shifts from forward to backward the hysteretic torque undergoes a change like that in the magnetic flux of a ring when the magnetizing force is reversed. The change is at first slow and then it is rapid. Consequently at synchronism there may be either a positive or a negative hysteretic torque, depending on the phase, but a small change of phase will reverse it.

A LOGICAL UNIT OF POWER.

The committee on units and notation, representing the German electrical engineering profession, has recently published, as already noted in the Digest, several proposals for the improvement of electrical nomenclature. Some of these are in the direction of necessary and desirable standardization of practice, but one strikes us as being, although somewhat revolutionary, decidedly pertinent and important. This proposition is to abandon the time-worn and somewhat indefinite horse-power for the kilowatt, which is just as good a mechanical unit as it is an electrical one. It is, in fact, the point of contact between the electrical and mechanical absolute systems. When the electric motor was new and totally unfamiliar to non-technical men it was reasonable to rate it as steam engines were, and are, rated in horse-power; but as time has gone on and the electric motor has replaced the steam engine to a very large extent it seems like an obsession of conservatism to cling to an illogical unit of power bearing no simple relation to the modern absolute system and based upon ancient experiments never precise and possessing nothing more than historical significance. The German proposition is to christen the kilowatt as a mechanical unit the "Neupferd." This seems to us a totally unnecessary concession to an old-time blunder. The kilowatt, just as it stands and without change of name, is a perfectly good unit for mechanical purposes, being equivalent as it is to 10^{10} ergs per second. We see no reasonable excuse for offering an apology in the way of a new name. To rate a motor in kilowatt mechanical output is an entirely simple and straightforward proposition and one that deserves very serious consideration.

It is an interesting bit of history, not in the least detracting from the merit of the German proposition, that the substitution of the kilowatt for the horse-power was vigorously advocated during and for some time after the Philadelphia electrical exhibition of 1884; and that the earliest of the three-phase motors built in this country were deliberately rated in kilowatt output. The time was, however, not ripe in the early eighties for dropping the horse-power, and the attempt later to put motor rating on the basis of the absolute system proved futile. Now after nearly twenty years of familiarity with the electric motor the time would seem to be ripe for the change, and we trust that the German proposition will meet with acceptance in Germany and out. There is, besides the logical reason for the change, the practical one that the French *cheval-à-vapeur* and the horse-power used in England and Germany are not quite the same. The difference is not enough to prove confusing, it is true, but it exists, and in nice measurements would have to be allowed for. The new rating, too, would have the considerable advantage of being a real rating as applied to electric motors, and not a more or less hypothetical rating like the horse-power as applied to steam engines, and leads to the simplest possible relation between input, efficiency and output. By all means let us escape from a cumbersome and worn-out unit of indefinite significance, when there is so good an opportunity to establish a logical rating in definite relation to the absolute system of measurements in general use for scientific purposes.

COMPOUNDING POLES FOR DIRECT-CURRENT MACHINERY.

The action of the so-called "split-pole" converter has become well known on account of the numerous discussions that arose when the machine was first announced. The field structure is so arranged and the field coils so operated that the field flux distribution is regulated as may be desired in order to vary the measurable voltage at the commutator without varying the collector-ring voltage. It is evident that the split-pole arrangement can be used in the same manner to regulate the commutator voltage when the machine is used as a direct-current generator rather than a synchronous converter. However, when used for this purpose the machine would possess no operating advantages over the usual compound-wound generator and would be somewhat more expensive to build. In a similar manner the split-pole scheme could be applied to direct-current three-wire balancers of the two-unit motor-generator type, without any advantages to compensate for the extra cost over the arrangement commonly employed. It is possible to build a direct-current three-wire balancer with two armature windings mounted on a common core situated within a common field structure. The disadvantage of this arrangement when use is made of the common form of field core is that when the load is unbalanced the voltage on the more heavily loaded side decreases, while that on the other side increases, and no amount of field-current adjustment can alter this condition. In the Digest of this issue is described a form of three-wire balancer in which this disadvantage has been overcome by the use of the split-pole arrangement. The series-wound poles are mounted between the main field poles and the brushes on the two commutators are so placed that the flux in the interpoles tends to increase the emf between one set of brushes, while it decreases the emf between the other set. The two sets being connected in series and subjected to a constant total emf, the division of emf by the balancer depends only on the relative loads on the two sides of the system. The balancer can be arranged to maintain a constant division of emf or to compound as may be desired. It would seem that the machine can be given operating characteristics well suited for balancer operation, but in this respect it appears to be neither better nor worse than a motor-generator balancer with compounded machines. However, it should require somewhat less material to construct than the complete two-machine unit, and hence should be able to compete successfully with this unit on the basis of first cost and operating efficiency.

A RAILROAD INVESTIGATION OF THE ELECTRIFICATION PROBLEM.

The Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals—to give it the full official title—is now at work in a suite of offices which has been taken for its use in one of Chicago's downtown office buildings. In due course a comprehensive report from this committee may be expected, and it is, therefore, of interest to the electrical industry, which is deeply concerned by the possibilities of railway electrification, to pay some attention to the manner in which this investigation is being made, as Chicago is such an important railroad center that the report of the committee will no doubt receive wide attention. The committee is organized under the auspices of the Chicago Association of Commerce with the purpose of making an investigation of the practicability of electrification of the railroad terminals of Chicago, particularly with reference to smoke abatement. The committee is made up of business men, including a number of steam-railroad officials, and its chairman is Mr. Jesse Holdom, a lawyer and former judge. The railroads are defraying all the expenses of making the investigation, and the chief engineer retained by the committee is Mr. Horace G. Burt, former president of the Union Pacific Railroad and an engineer by profession. Assisting him are Messrs. Louis H. Evans, terminal engineer; Hugh Pattison, electrical engineer, and Theodore H. Curtis, mechanical engineer. Mr. Evans was recently chief engineer of the Chicago Junction Railway; Mr. Pattison was connected with the electrification of the Pennsylvania Terminal, New York, and Mr. Curtis was superintendent of motive power and machinery for the Louisville & Nashville Railroad. Mr. Burt and his three engineering assistants are men of high character and professional attainments. Electrical men cannot fail to remark, however, that as the expenses of the committee are borne by the steam railroads, and as the engineers employed by the committee are men of long connection with steam-railroad practice, it may be difficult for them to study the possible use of electricity, however honestly they may intend to do so, with absolutely unbiased minds. It is a case where the railroads are investigating themselves, no doubt with the most honorable intentions, and electrical men should be conversant with the situation.

At the recent convention of the American Institute of Electrical Engineers in Chicago, when the subject of the electrification of railroads was under discussion, a steam-railroad engineer of prominence declared that there is no work in heavy trunk-line service that the electric locomotive cannot perform more efficiently than the steam locomotive. This gentleman said that steam-railroad men are making a mistake in attempting to ward off something that is inevitable, and he intimated that the engineers making the present electrification investigation in Chicago might report that it would cost $250,000,000 to electrify the Chicago railroad terminals and that it would be impracticable. He said, however, that the entire terminal situation should be revised and that electrification was desirable within a certain reasonable limit. No one will dispute that the general electrification of the Chicago railroad terminals will prove a task of great magnitude, involving serious and careful consideration. No doubt this consideration will be given to it by the engineers of the Chicago Association of Commerce committee. However, as has been pointed out, these gentlemen are all, or nearly all, men of steam-railroad antecedents, and if they have any leaning it is not to be imagined to be toward electrification. Further, it may be remembered that the railroads are providing the funds for making this investigation and, although they are no doubt as anxious as any one to discover the true ultimate solution of the problem, it is possible that there exists the hope that electrification may not be found to be immediately necessary.

Convention of the Electric Vehicle Association of America.

The second annual convention of the Electric Vehicle Association of America will be held in the Engineering Societies Building, New York City, Oct. 10. A program has been arranged tentatively by Mr. Frank W. Smith, of the United Electric Light & Power Company, chairman of the papers committee, as follows: *Electric Vehicle Commercial Problems,* by Messrs. R. L. Lloyd and John Meyer; a paper dealing with the *Work Done by the Boston Edison Company in Its Electric-Vehicle Campaign* will be prepared by Mr. E. S. Mansfield; a paper dealing with the *Electric-Vehicle Problem for Commercial Trucks* from the manufacturers' viewpoint will be prepared by Mr. E. W. Curtis, Jr., of the General Vehicle Company; *Proper Illumination of an Electric Garage,* by Mr. J. C. Henninger; *Vehicle Battery Practice in Central-Station Companies,* by Mr. S. C. Harris, of the New York Edison Company; *Gasoline vs. Electric Vehicles,* by Mr. Hayden Eames; *Advertising the Electric Vehicle,* by Mr. Louis Ferguson, of the Commonwealth Edison Company, and papers on the *Electric Pleasure Vehicle, Care and Maintenance of Tires,* and *Electric-Vehicle Service in the Fire Department of Springfield, Mass.,* the authors for which have not been chosen. In addition to these, a representative of the General Electric Company will present a paper on the *Storage-Battery Locomotive.* Inasmuch as the convention will be held at the time of the electrical show at the new Grand Central Palace, New York City, the association will have an exhibit consisting of photographs of garages, installations, etc., of electric vehicles on the third floor of the palace.

Convention of Georgia N. E. L. A. Section.

The first annual convention of the Georgia Section of the National Electric Light Association will be held at Columbus, Ga., Sept. 26 and 27. The sessions will be held in the Masonic Temple and the registration bureau will be located in the Muscogee Club. There will be no exhibition, but members are invited to visit the showroom of the Columbus Railway Company. The entertainment will include visits to the various clubs, golf courses and theaters of the city and a trip to the Goat Rock dam of the Columbus Power Company and an evening boat ride. Following is a list of the papers to be presented:

Advantages of Co-operation Between Central Stations and Insurance Inspectors, by Mr. A. M. Schoen, of Atlanta; *Low-Pressure Services,* by Mr. E. H. Ginn, General Electric Company; *Supply of Electric Energy to Textile Mills,* by Mr. George K. Hutchins, Columbus Power Company; *Ice Making as Associated with Central Stations,* by Mr. Burdett Loomis, Jr., of Waycross, Ga.; *Electric-Heating Utensils,* by Mr. L. L. Warfield, of the Westinghouse Electric & Manufacturing Company. Mr. Thomas W. Peters, Columbus Railway Company, Columbus, Ga., is secretary of the association.

Convention Program of the Association of Edison Illuminating Companies.

The following papers are scheduled for presentation at the convention of the Association of Edison Illuminating Companies at Spring Lake, N. J., Sept. 19-21: *Accuracy of Meter-Testing Methods,* by Messrs. Burleigh Currier and J. B. Seaman; *Effect of Width of Maximum Demand on Rate Taking,* by Mr. Louis A. Ferguson; *Thermal Application of Electricity,* by Dr. William Stanley; *Presentation of Technical Facts to the Laity,* by Mr. John C. Parker; *What the Central Stations Can Gain from the Latest Progress in Electric Energy Transmission,* by Mr. Philip Torchio; *Life Valuation of Incandescent Lamps, as Deduced from Their Performance,* by Messrs. P. S. Millar and L. J. Lewinson; *Improvements in the Incandescent Lamp,* by Mr. John Howell; *Securing the Business of Office Buildings, Department Stores and Hotels,* by Mr. E. W. Lloyd; *A General-Service Depot,* by Messrs. C. A. White and C. H. Crockett; *Tests of Large Boiler Units at the Detroit Edison Plant,* by Dr. D. S. Jacobus; *Practical Experience with Employees' Welfare Plans,* by Mr. W. W. Freeman; *Notes on Industrial Movements Abroad,* by Mr. Arthur Williams; *Electric Light Accounting from the Standpoint of Public Service Commissions,* by Mr. H. M. Edwards. In addition to these papers reports will be made by the meter committee, heating committee, storage-battery committee, electric-vehicle committee, committee on the national code, committee on incandescent lamps, committee on high-potential disturbances, committee on steam turbines, and an address by Dr. C. P. Steinmetz.

Conference of Governors of States.

The third conference of governors of states was held at Spring Lake Sept. 12 to 16, at which two subjects were considered that have an interest to several branches of the electrical industry. One of these dealt with workmen's compensation for injuries, which formed the subject of a remarkably able report of the N. E. L. A. public policy committee, presented at the May New York convention of that body, and is a matter now under serious consideration by electrical operating companies. The other subject was public-service regulation. An abstract of the discussion of the first-mentioned topic is given below, and a report will appear next week of the discussion on public-service regulation.

EMPLOYERS' LIABILITY AND WORKINGMEN'S COMPENSATION.

Two papers on the subject of employers' liability and workingmen's compensation were submitted on Wednesday, Sept. 13, one by Governor Foss (Massachusetts) and the other by Governor Hay (Washington). Chairman Burke (North Dakota), who presided at the meeting, said that, in his opinion, the subject of workingmen's compensation is the most important to come before the conference.

PAPER OF GOVERNOR HAY OF WASHINGTON.

Governor M. E. Hay of Washington in his paper gave details of a workman's compensation act passed this year by the Legislature of his State. In introducing the paper Governor Hay denounced indemnity, casualty and liability companies as "fungoid social parasites." Out of the $600,000 collected from the employers of the State of Washington in 1909, only $100,000, he said, ever reached the injured workman or his family, $500,000 thus being withdrawn from the avenues of commerce and industry and transferred to the army of officers, agents, adjusters and stockholders of liability companies. He denounced the system of technical defense in indemnity suits which has grown up and been distorted by court precedent to the point where the recovery of damages becomes a mere question of skilled lawyers, sympathetic juries and luck. When Oregon abolished its technical defenses the indemnity companies raised the rates 400 per cent.

Governor Hay said that when the industrial conditions in Washington had become intolerable the Tacoma Chamber of Commerce called a meeting of the leading manufacturers and labor men of the state to discuss employers' liability and workmen's compensation for injury, and invited the Governor to preside during the conference. As a result of this movement a commission consisting of ten members was appointed to draft a workmen's compensation bill, which, with some amendment, was passed by the Legislature during the present year.

The new law applies only to extra-hazardous occupations.

which are classified under forty-seven heads. One of these classes includes the construction of electric-light and power plants, telegraph and telephone systems and electric railways. Three other classes cover respectively the operation of electric-light and power plants, of street-railway and of telegraph and telephone systems. The Governor in his address cited as a notable example of the spirit in which employers are accepting the act the cases of the Seattle, Tacoma, Bellingham and Everett electric railway, lighting, power, telephone and telegraph companies, which are not only voluntarily segregating their pay-rolls into hazardous and non-hazardous classes, but are taking advantage of the "elective-adoption" feature of the law, whereby the employer and employees may jointly agree to place themselves under the provisions of the act, even though their work is not hazardous in any degree.

The fund for the payment of compensation is obtained by assessing the employer a sum equal to a definite percentage of his total pay-roll for a year. The percentages are different for each of the forty-seven classes, and each class of the industry is assessed for the accidents occurring in that class and for no other. The rates are subject to readjustment, depending upon the number of accidents and need for compensation of injured workmen. The first assessments are levied on the pay-rolls of October, November and December of this year, and no further assessments will be made on any class, unless the accidents occurring in that class deplete its fund to a point when it is necessary to call for more money.

Injured workmen, their families or dependents are paid certain sums out of the fund, and cannot recover by law except where the injury is caused by intent of the employer, in which case the workman or his family may recover not only the sum due under the act, but may sue for any demand in excess of this sum. Where a workman is injured because an employer has neglected to observe the safeguards required by law or by the regulations of the department the employer must pay 50 per cent more than the fixed amounts. Where the workman injures himself intentionally he receives no benefit. No part of the premium can be deducted from the wages of the workman, the violation of this section by the employer being made a gross misdemeanor, punishable by one year in the county jail or a fine of $1,000, or both. The State provides for the administration of the law, and for this purpose sets aside $150,000, so that none of the money in the general fund is used for the expenses of the commission. The act enables the commission to raise the rate of a particular industry or firm which conducts its business in a notably careless or negligent manner, thus tending to compel a closer observance of factory laws and assist the work of the labor commissioner in the inspection of mills and manufacturing plants.

Governor Hay said that the wisdom of the classification of industries is already seen in a certain class pride, many industries making a concerted effort to hold their casualties down and thus lower the net cost of carrying insurance. The lumbermen, for example, are considering a system of private inspection to guard against negligence and accidents in their own class, thus preparing for a satisfactory annual adjustment, such as is provided for by law, and a possible reduction of their rate by the next Legislature.

The schedule of payments for various injuries is as follows: First, in case of death, the expenses of burial, $75. Payment to widow or invalid widower of $20 per month while unmarried, or $240 in a lump sum on remarriage of widow. For each surviving child under sixteen, $5 per month, the whole monthly payment being limited to $35. If no widow or widower survives, $10 a month to each child under sixteen, the same rule applying to children who become orphans by death of the surviving parent, with a monthly limit of $35. Dependents get 50 per cent of the average monthly support formerly received from the deceased workman, limited to $20 per month. The parents of deceased unmarried workmen receive $20 per month up to the time the deceased would have been twenty-one years old. When totally disabled, which disability is specifically defined in the act, the payment is $20 a month if unmarried; if supporting a wife or invalid husband $25, or if the husband is not an invalid $15; for each child under sixteen an additional $5 a month up to a total of $35. In case of death of the totally disabled workman the wife or widower receives $20 a month until death or remarriage and $5 per month additional for each child under sixteen; orphaned children receive $10 a month. When partially disabled as defined in the act a workman receives a certain cash lump sum up to $500. The parents of an injured workman under twenty-one and unmarried also receive 10 per cent of the amount awarded the injured minor. If the injured workman resides or moves out of the state the commission may lump the monthly payments into one sum not to exceed $4,000, as based on the American mortality table.

PAPER BY GOVERNOR FOSS OF MASSACHUSETTS.

Governor Foss said that workingmen's compensation is essentially a business subject, and as such it ought to be brought to a uniform level throughout the United States. In his inaugural message he urged on the Massachusetts Legislature immediate and equitable legislation on the subject, setting forth that the criterion of such a law must be definite, certain and speedy adjustment of all claims, so that they may be discounted alike by capital and by labor, and that the results of such a law should not be measured merely by financial considerations, but by the better relations which will be brought about between the employer and employees. He also urged that it was not sufficient to say in answer that Massachusetts had a just law, giving compensation to an injured workman at once and without the necessity of a lawsuit. Referring to the desirability of uniformity of state legislation on the subject, he said that at present the award of compensation for industrial injury may be acceptable to the highest court in Massachusetts and yet be declared unconstitutional in New York State. While, he said, we like to think of our states and our country as the home of popular rights, yet in this matter of simple justice to workmen it is painful to realize that almost all of the rest of the industrial world has abandoned the old principles of employers' liability in favor of the broader and more liberal spirit of workmen's compensation. In this country we are behind the times in this matter, which situation ought to incite vigorous effort toward the establishment of this fundamental right of labor throughout all the states of the Union.

The federal government five years ago applied the principle of automatic compensation for injuries to workmen in its employ on the Philippine Islands, and three years ago this was followed by a similar law protecting all workmen working in government arsenals, navy yards, fortifications and other hazardous employment under federal jurisdiction. Later, protection was extended to federal employees working in the Panama Canal zone, and legislation is now pending which will include a still larger number of men and women employed by the federal government.

Governor Foss then took up the discussion of the recent Massachusetts law on the subject, which, he said, had been sanctioned by the Supreme Court as constitutional. The law will not go into full effect until July, 1912, thus giving employees an opportunity to study its provisions and to meet them. As originally drafted the bill eliminated the private insurance companies and substituted a state insurance association, the purpose being to do away with the great loss both to employers and employees through the large profits made by these companies. This could not, however, be achieved, the insurance companies being strong enough in the Legislature to defeat the provision. The law as it stands permits a corporation to insure itself against accident casualty in any of the established liability

companies or in a specially created state association. The act establishes a mutual liability insurance company, which has fifteen directors appointed by the Governor. Any employer may become a subscriber, and each subscriber is entitled to one vote, with another vote for each additional 500 employees, up to twenty votes. It is not, however, of fundamental consequence in the act how the employer shall insure himself, provided always that he makes suitable provision for the payment in full of all compensation which may be due from him to his injured workmen.

The law does away with the defenses of negligence on the part of the injured employee or fellow employee and with the assumption that he assumed the risk of injury as a condition of employment. The schedule of compensation provided is as follows: For two weeks after an injury a workman is entitled only to receive medical and hospital services; in case of death the dependents, if any, are to receive a sum equal to one-half of his weekly wages, extending over 300 weeks, the maximum being $3,000, the compensation being less when there are only partial dependents; in case of total incapacity the payment is up to a maximum of $3,000, figured at one-half of the average wages for 500 weeks; in the case of partial incapacity a similar schedule holds, with a maximum of 300 weeks. For certain specified serious injuries, as, for example, the loss of both eyes or both hands, an additional compensation up to $1,000 is paid. There is no compensation if the injury results from the workman's seriously wilful misconduct; and if the injury results from the seriously wilful misconduct of the employer the nominal compensation is arbitrarily doubled. An employee has no right under the act to recover damages by common law unless he gives the employer notice in writing that he claims such a right, and even in this case the claim may be subsequently waived. A wife living with her husband, a husband living with a wife, a child or children under eighteen years of age, or older if physically or mentally incapacitated, are presumed to be totally dependent upon the injured party. If an injured employee refuses to submit to a physical examination by a physician or surgeon the right to compensation is suspended. No employee can waive his rights to compensation or enter into an agreement to that effect, and no payment made under the act is assignable, subject to attachment or liable in any way for debt.

For the administration of the act the Governor appoints an industrial accident board of three members, maintained by the commonwealth, the chairman receiving $6,500 a year and the other members $6,000 each a year. Provision is made for a secretary at $3,000 a year, and the board is allowed $10,000 a year for other expenses. Claims for compensation, if agreed upon by the employer and employees, are filed with this board, and if approved by it the agreement becomes enforcible as equivalent to a decree of the Superior Court. In cases where the employer and the injured employee fail to agree the board calls for a committee of arbitration of three members, one a member of the board and the other two named respectively by the injured workman and by the employer or the association which represents the latter. This committee shall investigate the case and its decision shall be enforcible as equivalent to a decree of the Superior Court. If, however, the findings of the committee are not satisfactory to both parties, then the board itself shall pass upon the case. If a case brought before the board is found not to rest upon reasonable grounds the whole cost of the proceedings is assessed upon the party who brought or defended the action.

Governor Foss laid stress upon the fact that the Massachusetts law provides for payment of claims to relatives who are non-residents. In twenty-two states such relatives are compelled to enter suit for the purpose of establishing their claim, with the result that many employers actually prefer to hire foreign workmen for the reason that if these men are killed the non-resident families cannot readily make an appeal for compensation. The attitude of the Massachusetts Supreme Court has been clear and fearless on this point.

Governor Foss referred to the past system of workmen's compensation as vicious for a number of reasons. An industrial accident, for example, instantly lines up the employer and employee as parties in a lawsuit, from which it is difficult to keep out a spirit of hostility. At present only one-half or less of the amount of money paid out by employers for compensation gets to the injured employee. For instance, 327 firms in New York State spent $192,538 in 1907 on account of accidents, legal expenses, etc., of which the injured workmen received only $104,642. The casualty insurance companies during the years 1906 to 1908 took in premiums to the amount of $23,000,000 and disbursed in payment to injured men and their families only about $8,500,000. In the latter case there was thus a direct loss to the employer and to the employees and a tax on the industry of about $15,000,000 in three years through nine insurance companies.

The latter part of Governor Foss's paper is devoted to a discussion of the legality, ethics and economics of workmen's compensation laws. The conclusions are that such compensation is fully justified in the basic industrial law of costs; that it has excellent claims to recognition as a proper exercise of the general peace power of the state, which cuts through a good many personal rights in order to establish and maintain in general life, safety and order; that in its broad working such compensation will not increase but only distribute the total burden of payment for injuries and deaths, and that the only obstacle which impedes the establishment of workmen's compensation laws in all states uniformly is that an employer in any one industry can successfully oppose the imposition of any sort of tax which some neighboring industry or enterprise does not share. The final conclusion is that when such charges are equitably distributed, then there will be as sound a basis for them as there is now for personal property taxes. The final paragraphs of Governor Foss's paper related to the avoidance of accidents, the establishment of workmen's compensation laws, necessarily bringing this matter sharply to the attention of manufacturing interests and causing them to provide more adequate provisions for safeguarding workmen from dangerous conditions.

Discussion.

Governor McGovern (Wisconsin) said that his State had now a law in operation like that of Massachusetts. Its application is voluntary, and both employers and employees have shown a willingness to come within its operations. An important difference between the laws of Massachusetts and Wisconsin is that the latter has conferred upon its industrial commission not only the administration of the compensation act, but also has given it cognizance of all conflicts between employers and employees. That is, the whole matter of the legal relation, so far as the public is concerned, between the employer and employees has been turned over to the commission. This body has also under its jurisdiction free employment bureaus, factory inspection, truancy, application of safety devices, etc. He considered it as making for economy and for efficient administration of the law to confer upon the commission having jurisdiction of industrial disputes authority to inspect factories, mines, etc., where such disputes arise.

Governor Wilson (New Jersey) said that his State had pased a law similar to that of Massachusetts. Owing, however, to the limits imposed by the constitution of the State, the Legislature has not the right to pass compulsory measures of this character. What therefore most interested him in the papers presented was the discussion of the constitutional difficulty. The New Jersey act is divided into two parts, the first of which abolishes the common law defenses and the second provides a scheme of compensation

similar to that of Massachusetts. The indemnity companies, he said, had created trouble, having raised their rates in some cases as high as 1000 per cent. He believed these companies were singularly unwise and that they were adopting an attitude which would ultimately compel the establishment of state insurance. Under present conditions employers doing a small business, or small corporations, may not be able to stand the strain of the exactions of these companies. In this case the security afforded by the law is extended only to those employers who can meet the exigency. New Jersey, therefore, cannot protect all classes of workmen until it can assure that all claims for injuries shall be paid, whatever the circumstances. All employers of the State have not been inclined to meet the law half way and some of them have determined to test its validity.

Governor Hadley (Missouri) recalled that the workmen's compensation law enacted by the New York Legislature had been declared unconstitutional by the Court of Appeals of that State, and called the attention of the conference to a report of the law committee of the Civic Federation which deals with the decision of that court. The argument made there is that the common law is not a "strait-jacket"; that it is elastic and can be made to conform to particular classes of problems. Governor Hadley said that of the $95,000,000 contributed by employers of the country to indemnity companies only $40,000,000 had reached the injured workmen or their families. He also pointed out that the lives lost and injuries sustained annually by workmen in the pursuit of their occupations exceeds the number killed and wounded in modern warfare between nations.

Governor Stubbs (Kansas) gave an account of the Kansas law, which, he said, is quite different from the laws of Massachusetts and Washington. The provisions of the act are voluntary in application and apply only to hazardous industries, such as railroads, mining, gas, explosives, etc., and only to employers of fifteen persons or more. Employers may elect not to come within the provision of the act by written notice. In certain cases there is a right of choice between the existing liability law and the compensation provided for in the act. The workmen of a sub-contractor may recover indemnity from the principal, who in turn may recover from the sub-contractor. An employer shall not be liable for compensation to an employee if the latter drinks or if the injury is caused by the violation of a statutory regulation, or for any injury which does not disable him for at least two weeks from earning his wages. The amount of compensation allowed is as follows: In the case of his death, to dependents upon the workman's wages, three times his earnings for the preceding year, or not less than $1,200 nor more than $3,600; if employed less than a year, fifty-two times the weekly earnings. If the deceased or injured has no dependents, then only reasonable medical or burial expenses are allowed. Arbitration is provided for by means of a committee representing the employer and the workman, or through an arbitrator agreed upon by the parties, or appointed by the court. Governor Stubbs believes that the compensation for workmen killed or injured in the interest of society should be borne by the respective classes of society. Since a railroad has to pay for its plant, its machinery, etc., it should, on the same principle, be made to pay for the lives of the men killed while in the railroad service.

Governor Harmon (Ohio) said that the feature in which the Ohio law differs from the other compensation laws is that the act makes no classification, leaving this matter to the commission appointed to administer the law. It was thought that the commission could, from the results of investigation, form a better classification than the General Assembly. It seemed to be the general desire in Ohio to make the law a success, and there had been no threat of interference with its application, except from the indemnity companies.

Governor Burke (North Dakota) expressed the opinion that the state had through its police power ample authority to pass compulsory compensation laws.

Pittsburgh Branch Meeting of A. I. E. E.

The first meeting of the season of the Pittsburgh branch of the American Institute of Electrical Engineers was held Tuesday evening, Sept. 12, in the rooms of the Engineers' Society of Western Pennsylvania, Oliver Building. The meeting was called to order by Mr. H. N. Müller, the retiring chairman, who announced that the officers for the ensuing year should be elected and reported the ticket nominated by the committee, which was unanimously elected. The officers chosen were: Chairman, Mr. K. C. Randall, of the Westinghouse Electric & Manufacturing Company; secretary and treasurer, Mr. E. L. Farrar, of the General Electric Company; executive committee, Messrs. R. S. Feicht, Westinghouse Electric & Manufacturing Company; E. P. Van Kirk, Westinghouse Air Brake Company; S. P. Grace, Central District & Printing Telegraph Company; R. W. Atkinson, Standard Underground Cable Company; E. Friedlander, Carnegie Steel Company; R. V. Bingay, Pittsburgh Transformer Company.

Mr. Müller, as delegate from the Pittsburgh Section to the Chicago convention, gave a brief report of the proceedings of the convention and later spoke of the section work. Mr. Paul M. Lincoln, chairman of the sections committee of the parent body, spoke along the same lines.

The topic of discussion for the evening was high-tension transmission as discussed in the Chicago convention papers. The discussion was opened by Mr. W. M. McConahey, engineer on transformers of the Westinghouse Electric & Manufacturing Company, who briefly reviewed the various papers presented on the subject and gave his own views on the topic. The paper by Messrs. Pender and Thomson, he said, dealt with the subject from a very mathematical standpoint and required close application to follow it. Some of the formulas in this paper were discussed later on by Mr. C. Fortescue, who suggested some easier solutions than those given by the authors.

The paper on corona by Mr. Piek, the speaker said, covered a subject that heretofore has been of little importance, but lately has become very important because of the increasing use of high-tension transmission systems—that is, those using 100,000 volts and upward. This subject was discussed later by Mr. S. W. Farnsworth, of the Westinghouse Electric & Manufacturing Company, who explained the action of corona and its cause in a most interesting manner by the use of two metallic spheres and the lines of force passing between them. He said that it seemed from reading a discussion of the subject that many engineers were really unaware of what corona and its cause actually were.

The design of transformers to protect them against heavy surges was discussed by Mr. H. C. Soule, who explained the necessity of insulating the end turns very heavily and bracing the coils by means of blocks or clamps.

The equipments of the four high-tension transmission companies—the Great Falls Power Company, the Central Colorado Power Company, the Great Western Power Company and the Southern Power Company—were discussed and compared.

Mr. McConahey stated that all the companies use ground wires and reported great success from their use, but he was inclined to think they gave excess credit to the ground wires to the exclusion of the lightning arresters, which undoubtedly did much toward lessening the damage done by lightning.

Mr. McConahey also spoke of the connection of transformers, whether delta or star, and stated that it does not

seem to be very generally known that one can remove a damaged transformer from a star-connected bank under certain conditions and thereby gain the other advantages of the star connection, such as least cost and lower voltage transformer. The general consensus of opinion seemed to be that high-tension transmission has not developed sufficiently to enable construction methods to be standardized, as equally capable engineers are using widely different methods under practically the same conditions.

Association Island Meeting of Lamp Manufacturers.

The fall meeting of manufacturers of incandescent lamps was held at Association Island during the week of Sept. 3. Two days, Sept. 6 and 7, were devoted to a commercial program consisting of discussions of numerous subjects pertaining to the development of electric lighting.

The general theme of the occasion was "co-operation"—co-operation on the one hand between the lamp manufacturer and buyers and users of lamps, and, on the other hand, co-operation among the several factors in the industry, such as jobbers, dealers, central stations, etc., all for the purpose of accomplishing the most widespread possible use of electric light. The entertainment features, which were much enjoyed, were also of a co-operative nature. There was co-operation between Mr. L. P. Sawyer, of the Buckeye Electric Company, and Mr. E. H. Haughton, of the Bryan Marsh Company, each of whom was the chief of a co-operative black-hand organization. Each assessed the people in attendance on the assurance that he needed protection from the other. After the assessments had been paid the proceeds found their way into a common pot which, it developed, was to be used to purchase a pirate ship for the use of the black-handers next season. There were about 100 people present at the meeting, among them being jobbers, contractors, central-station men and representatives of the electrical press, as well as the lamp manufacturers.

Mr. A. D. Page, of the General Electric Company, presided at the several sessions of the convention. Mr. F. S. Terry, chairman of the executive committee of the Association Island Corporation, at the opening session spoke briefly on the subject "Association Island." He explained what the island is and what it is for. It contains about 67 acres of land and is located in Lake Ontario, about 3 miles from Henderson, N. Y. The property is owned by forty individuals, all of whom are more or less directly connected with the business of manufacturing incandescent lamps. The charges to those who use the facilities of the island are made just enough to pay expenses. The life is delightfully simple and primitive. The buildings on the island are a general office or store, a dining hall, a bowling alley, a boathouse and meeting hall and a general storehouse. All of these are permanent buildings. The islanders sleep in tents, of which there are upward of seventy. In the spring and the fall the place is used for business meetings by the lamp people. In the summer it is a playground for their families and friends.

Mr. Terry said that the original purpose or motive, as a business matter, was to have some place away from the hotels and offices in which business conferences were usually held. It was believed that when men meet in an informal spirit under informal surroundings they can sometimes see things more clearly and act more fairly than they otherwise would. That, Mr. Terry declared, was the idea of the island.

Mr. E. L. Elliott discussed tungsten street lighting from the citizen's viewpoint. He claimed that civic pride is the one factor most effective in the introduction of decorative street lighting along the main thoroughfares, but presented arguments to show that investment in ornamental street lighting pays from the business standpoint. Reports from real-estate experts in various cities, including Billings, Mont., and Des Moines, Ia.; Toronto, Canada; Montgomery, Ala., and Chicago, showed an appreciable increase in property values along streets equipped with decorative lighting installations. The increase in rental of the adjacent property alone is sufficient to pay the cost of the lighting equipment. He explained the fact that the results from decorative lighting installations in Salt Lake City had been unsatisfactory as due to lack of co-operation among the various parties interested.

In discussing Mr. Elliott's paper Mr. Henry L. Doherty remarked that the introduction of incandescent lamps for street lighting has been attributable to the desirability of a single illumination system, rather than a multiplicity of different systems. He outlined tests which showed the ineffectiveness of arc lighting as compared with incandescent lighting. He has observed the flaming-arc lamp in use abroad to a considerable extent for street lighting, with results that would not be considered satisfactory in America. From the viewpoint of appearance it is offensive and its use is detrimental to the central station in that it tends toward a low degree of illumination. Mr. Doherty predicted increased success as a result of the continued application of the methods employed in America.

Mr. V. R. Lansingh, of the Holophane Company, reported the results of tests which indicated that the effectiveness of lighting by clusters of incandescent lamps is from 35 per cent to 50 per cent greater when the balls are pendent than when they are upright. Fifteen per cent of the flux produced by the lamp is absorbed by the socket and the covering of the opening through which the unit is inserted. When the ball is placed upright above the cross-arm this amount fails to reach the ground. Moreover, the glass of which the ball is constructed is thicker surrounding the opening than it is diametrically opposite the opening. On this account the thick glass acts to increase the illumination by reflection when the balls are pendent, but to decrease the effective flux by absorption and detrimental reflection when the balls are upright.

Mr. William Coale, of the Sterling Electrical Manufacing Company, explained that the results obtained with the incandescent street-lighting system at Warren, Ohio, had proved so satisfactory that the installation is a source of much pride to the citizens, who consider the place exceptionally well lighted. In a recent mayoralty contest, the cost of the street lighting being one of the points at issue, the candidate advocating reduction in the expenditure for this purpose was defeated.

Mr. Henry L. Doherty stated that information concerning the street-lighting equipment in Warren would be freely given to parties interested either by the management of the Warren company or by himself.

In his paper on "Competitive Illuminants for Street Illumination" Mr. Ward Harrison, of the National Electric Lamp Company, stated that for the purpose of illumination the streets of a city can be divided into three classes, the chief business streets, residence streets and the outlying streets, parks, etc. Along the business streets the illumination should be designed for advertising purposes, in order to attract people to that portion of the town. A cheap lighting unit for use where high intensity is required is found in the magnetite arc lamp. This unit possesses a disadvantage in that the glare is pronounced. The ornamental incandescent post lighting has proved highly satisfactory along business streets. The intensity of illumination is good, the appearance, both by day and night, is satisfactory, while the cost is low. Along residence streets lighting by incandescent lamps is cheaper and more satisfactory than by arc lamps. The author claimed that the cost for energy and maintenance of one 4-amp magnetite arc lamp is equal to that of five 60-cp tungsten units. With the magnetite lamps placed at 440-ft. intervals at street corners, and four of the tungsten lamps placed at 100-ft.

intervals, with one along the side street, the illumination by the incandescent lamp is much more satisfactory than by the arc lamps. At a point midway between the street corners the horizontal illumination from the incandescent lamps is 75 per cent better than from the arc lamps, while the illumination in the maximum position is 300 per cent better by incandescent than by arc lighting. Moreover, the uniformity of the lighting along the street is much better with incandescent than with arc lighting. The author claimed that of all arc lamps the magnetite lamp is the cheapest unit, and hence the above comparison would be even more favorable for the incandescent system in comparison with any arc lamp other than the magnetite.

Mr. W. D'A. Ryan, of the General Electric Company, expressed his agreement in general with all the conclusions of Mr. Harrison. He stated, however, that it is not proper to assume that the arc lamp is losing ground, the fact being that more arc lamps have been sold during the past year than in any other twelve months. He stated that the most attractive business decorative street-lighting installation with incandescent lamps is the five-lamp standard, with all of the units placed upright. It is not proper to ignore the fact that the light which is in the upper hemisphere is effective in illuminating the buildings, and thereby serves a useful purpose. In connection with the business-street lighting equipment in Minneapolis, an arrangement has been made by which temporary festoons of lamps can be connected to the post circuits by simply inserting a plug where desired.

Mr. A. M. Klingman, of the Adams Bagnall Company, Cleveland, Ohio, in discussing the efforts of the post manufacturers in developing the incandescent street-lighting business, explained that the so-called Daniels system of incandescent-lamp installation represents a modification from the earlier arc-lamp equipment to render it suitable for use with tungsten lamps. He complained of the practice of certain municipalities which obtain samples of posts from the manufacturers on a competitive basis and then allow local designers to copy the posts and have them manufactured in local foundries.

Mr. Eugene Creed called attention to the fact that in Columbus a total of 866 ornamental posts will be installed to supplant the arch-lighting system. He stated that although large cities prefer the arc to incandescent lamps for street lighting, the smaller cities prefer the five-lamp cluster incandescent-lighting equipment. He stated that the ornamental street-lighting installation in Toronto has not been found to interfere with the show-window and sign-lighting business.

Mr. J. L. Minick, of the Pennsylvania Railroad, expressed the opinion that, while incandescent lamps are most satisfactory for the lighting of business streets, arc lamps may be better for the outlying streets.

Mr. C. O. Baker, of the Wheeler Reflector Company, in outlining the work of the reflector manufacturers in developing the incandescent street-lighting business, remarked that with the introduction of tungsten lamps reflectors were designed for street lighting, the demand for these units being produced initially by effective advertising. Subsequently the satisfactory results obtained from each system were effective in inducing other towns to install similar systems. He claimed that in too many instances price rather than quality is the factor which determines the choice of street-lighting reflectors. The prime requisite for reflectors for this purpose is ruggedness.

Mr. V. R. Lansingh called attention to the recently introduced prismatic street-lighting fixture, which provides the maximum effective flux along the street surface, with the flux in the upper hemisphere properly minimized. This fixture has proved both ornamental and efficient, the lighting equipment being twice as effective as is the round-ball unit.

Mr. C. W. Bender, of the National Electric Lamp Company, outlined the policy which has been pursued in furthering the introduction of tungsten street lighting. Bulletins prepared especially for the purpose have been sent out, together with personal letters addressed to parties known to be interested in the subject, such as civic committees, etc. A collection has been made of data on street lighting, obtained from various cities, and offers were made of aid by the engineering department in instances where this was believed to be desirable. Maps were obtained of cities, in order to suggest lighting installations for the principal streets. The author claimed that the keynote of success in this connection is publicity, in order to obtain the necessary assistance founded upon civic pride in good lighting.

Mr. Philip S. Dodd, of the National Electric Lamp Company, offered certain suggestions for co-operation for the purpose of increasing the electrical business. He stated that in seven cities use is now being made of the plan of utilizing an electrical page in local daily papers at certain regular intervals. Such a page consists, for example, of articles in simple language devoted to subjects of general electrical interest. In connection with these articles are advertisements of electrical devices inserted by the local supply dealers, wiring contractors and central stations. He claimed that it is highly desirable for the central stations, jobbers and contractors in each city to co-operate in some such manner. He mentioned the book on electric-light publicity prepared by the sign committee of the National Electric Light Association and the book on house wiring arranged by the National Electrical Contractors' Association. Mr. Dodd entered a plea for co-operation immediately, at least along the line of publicity, and suggested the preparation of an elaborate book on street lighting and the formation of a committee to work through the National Electric Light Association to harmonize the electrical interests in each locality.

In his paper on "Lamp Testing" Mr. Preston S. Millar, of the Electrical Testing Laboratories, remarked that the testing of lamps is conducted for two different purposes, namely, to ascertain the characteristics of lamps and to determine the selection of lamps for various duties. The methods now employed in interpreting acceptance tests of incandescent lamps are illogical and unsatisfactory. It is improper to assume that when supposedly representative lamps, taken from a group selected from a large quantity of lamps, show very poor or very good performances all of the lamps in this group are either very poor or very good, the fact being that the group contains a large number of good lamps and a large number of bad lamps, just as would another group the representative lamps of which showed different characteristics under tests. The specifications for acceptance tests should be based upon a standard performance, and only a limited variation therefrom should be permitted. All lamps varying too widely from this standard should then be rejected. Life tests should be performed only upon a very large number of lamps, since the results obtained from tests made upon a limited number of lamps cannot always be properly interpreted. The maintenance of such a standard and the elimination of too wide a variation from this standard would result in an improvement in the life and performance of the lamps being manufactured.

Mr. J. L. Minick outlined briefly reasons for the present form of the specifications employed by the supply department of the Pennsylvania Railroad, on the basis of an evolution as needs arose from time to time. Representative samples are inspected and tested in order to insure proper manufacture, the use of good material, correct design and proper installation. Specifications are decided upon only after the holding of a conference of all of the parties interested. Mr. Minick's remarks related to specifications for all classes of supplies, and were general in their application to electric lamps. He stated that the supply department of the Penn-

sylvania Railroad carries in stock more than 200,000 separate parts. For financial reasons it is essential for the supply department to minimize the stock on hand, and hence it insists upon prompt delivery of goods as ordered.

Mr. Henry Schroeder, of the General Electric Company, presented data showing the advantages to the central station of giving graphitized-carbon instead of plain-carbon lamps in renewal. He stated that the power consumed by the so-called 60-watt graphitized-carbon lamp, when operated at the lowest voltage, is equal to that consumed by the 16-cp plain-carbon lamp, although the light from the former lamp is 20 cp. Thus, for the same power consumption there is an increase of 25 per cent in the light. The increase in the cost of the lamp to the central station on a free-renewal basis is about 0.01 cent per kw-hour, which is truly negligible. If this lamp is operated at medium or high voltage the power consumption is proportionately increased, with a very large increase in the candle-power. The income to the central station is thereby increased, while the service to the consumer is much improved. From these data the author concluded that the central station can ill afford to neglect the advantages offered by the graphitized-carbon over the plain-carbon lamp for free-renewal purposes.

Mr. Caryl D. Haskins, of the General Electric Company, presented a paper devoted to the development of electrical service in rural districts. He stated that of the 90,000,000 people in the United States only about one-third take advantage of the electric service offered by the central stations. In the United States at the present time there are about 2000 towns of sufficient size to support individual electric plants which have no electric service. There are about 4000 towns which have poor or relatively unsatisfactory service. On the basis of the per capita deposits in banks, the introduction of individual telephone systems, the extensive use of sewing machines, etc., the author claimed that the small community is better able to expend money for electric service than is the large community. In each of the three States of New York, Massachusetts and Wisconsin the ten towns having the highest central-station income per capita have populations smaller than 4000. The State of California, the larger portion of the population of which resides in small towns rather than in large cities, expends 80 per cent more per capita for electric equipment and service than does any other State in the Union. Mr. Haskins stated that the returns obtained by central stations from serving outlying communities have always proved to be much better than predicted from preliminary study. Even in certain negro-shanty communities in the South the central-station income has been very satisfactory, reaching as high as $11 per year per capita in certain cases. The author claimed that it would be better for central stations to exert efforts to increase the service in outlying or rural communities rather than in the more densely populated districts. He expressed the belief that two-thirds of the people not now receiving the benefits of electric service can be induced to become customers of the central station.

Prof. J. E. Latta remarked that the small communities throughout Kansas demand a twenty-four-hour service, which can be given most advantageously when the source of supply is a large transmission system rather than a local lighting plant.

Mr. William J. Hiss, of the American Bell Telephone Company, Buffalo, explained the methods employed in increasing the telephone business. A careful study is made of each community, its industries and prominent citizens. A house-to-house canvass is made not only to determine who are willing to become subscribers at once, but to ascertain the possibilities of installing a telephone for each family at some future time. Letters are sent to each possible subscriber at suitable intervals to maintain personal interest in the subject until the next visit of the solicitor. This method has been thoroughly effective, not only in urban, but also in rural communities. Rural telephone lines are of immense convenience to the farmers, and have proved profitable to the telephone companies.

Mr. M. L. Barnes, president of the National Electrical Contractors' Association, in discussing the co-operation between the lighting, lamp and contracting interests, stated that the membership of the National Electrical Contractors' Association, which now numbers 1000, is limited to men whose principal business is electrical contracting. The purchases of these men approximate the large sum of $50,000,000 annually, and hence their interests should be considered. He complained of a practice pursued by numerous central stations of selling electrical supplies directly to the consumer at or below cost. Such a policy is detrimental to the contractors and unprofitable to the central stations. He claimed that the central station, supply jobbers and manufacturers should co-operate. The contractors would thereby become solicitors for the central stations and would prove of great benefit to them. He called attention to the price data prepared by the National Electrical Contractors' Association, which is always kept up to date by means of loose leaves. At the present time about 1300 copies of this book are in use.

Mr. V. R. Lansingh described one case where the central station sold lamps and reflectors below cost, and the jobbers and contractors in that locality induced the central station to abandon this policy by threatening to advocate isolated plants rather than central-station service.

Mr. Barnes remarked that many of the central stations are now co-operating properly with the contractors and expressed the hope that such co-operation would become more widespread.

Mr. W. S. Bissell, of the F. Bissell Company, Toledo, claimed that the jobber is the natural outlet for the manufacturer and that co-operation between the jobber and the manufacturer begets reciprocity. For example, many of the jobbers distribute printed matter advertising the articles built by the various manufacturers.

Mr. John F. Gilchrist, president of the National Electric Light Association, in discussing the relation between the central stations and the lamp manufacturers, expressed the desire of the central stations for slowness in the introduction of revolutionary developments in the electric-lighting industry in order that equipments, business methods, rates, etc., can be gradually adjusted to the new conditions. He stated that the small central stations are dependent largely upon manufacturers for suggestions as to the equipments to be purchased. He expressed the opinion that the increase in membership of the National Electric Light Association will be quite as rapid in the future as in the past, his statement being based on the fact that there are perhaps on an average fifty people in each of the 6000 central stations of the country interested in the work being accomplished by the N. E. L. A.

Mr. W. E. Robertson, of the Robertson Cataract Company, of Buffalo, described the relations between Jovianism and the whole electrical business by stating that the proper plan for conducting business is one involving co-operation, each member contributing a little to the general interest of the electrical business as a whole. This spirit is identical with that of Jovianism, which stands for everything electrical all the time for everybody. He advocated strongly co-operation among the electrical interests in each locality, as exemplified by the electrical page inserted in the daily papers in Cleveland.

The session on Wednesday evening was devoted to an address on business co-operation by Mr. Elbert Hubbard. The speaker claimed that that which distinguishes civilization from the lack of civilization is the spirit of co-operation, which means mutuality. That is to say, as civilization increases the individual ceases to work alone, but combines his efforts with those of others to the increased benefit of all.

Convention of Vermont Electrical Association.

The Vermont Electrical Association held its tenth annual meeting at the Mountain Spring Hotel, Lake Dunmore, near Brandon, Vt., Sept. 13 and 14. At 10 o'clock the first day the executive session took place, when it was voted to indorse the resolution initially adopted by the St. Louis Section of the American Institute of Electrical Engineers, designed to promote the better security and greater value of industrial property by the government's introduction of a system of supervision in patent, copyright and trademark laws and requesting President Taft to call the attention of Congress to the subject and urge the establishment of a department of supervision of patents. A suggestion that the association come into closer relations with the University of Vermont's electrical engineering department was favorably received.

The following officers were chosen for the ensuing year: President, Mr. Frank Barney, Jr., Springfield, Vt.; first vice-president, Mr. William M. Hughes, Bristol; second vice-president, Mr. C. C. Wells, Middlebury; secretary and treasurer, Mr. A. B. Marsden, Manchester, Vt. Executive committee, Messrs. George S. Haley, Rutland; Walter H. Vorce, St. Albans; Wilfred Smith, Woodstock; F. H. Parker, Burlington; H. D. Larrabee, Montpelier.

At 3 p. m. an address was made by Prof. W. L. Upson, head of the department of electrical engineering, University of Vermont, the subject being "Electrical Engineering Education." The address was carefully studied, incisive and helpful.

The author remarked that electrical engineering is taught in two classes of school, the university and the trade school. The former lays stress on "education" and the latter on "engineering." The aim of the university is to teach the student to see in his life a much broader field for service than does the uneducated person.

The next speaker was Mr. Fred M. Kimball, of the Boston office of the General Electric Company, whose subject was "The Value of Power Load for Central Stations." After reviewing the process by which the small beginnings in electrical experimentation have been developed into the present-day enormous activities in connection with communication, transportation and motor service Mr. Kimball spoke of the particular uses to which electricity is being more and more adapted as follows:

To printing machinery, where its value in cleanliness, variations in speed, safety and economy are well recognized; to elevators, where devices for securing control in speed and direction of movement are more simple and effective than when any mechanical drive is used; for operating woodworking machinery requiring essentially a high rate of speed; for use in stores, markets, jewelry shops and by opticians; in shipyards and erecting works, in conjunction with machine tools that can be carried to various portions of floor or yard; in driving fans and exhausters, bellows, etc.; for use of bakers and confectioners, where perfect cleanliness is highly desirable; in pumping water for irrigation, a field recently entered upon and which promises large returns both to farmers and central-station companies; in lumbering operations, enabling portable mills to be operated anywhere on the lot; in small refrigerating apparatus; on docks, to move and load merchandise; in building operations, to raise material; in cash-carrier systems in stores; in laundry machinery, hotels, etc.; for quarry work, in drilling.

The output of motors is not far from 1,000,000 hp a year in the United States alone. The lighting end of station business is better developed than the motor-service department, the speaker asserted. He urged increased effort to round out the load of the central station by developing the motor-service business that is latent in every community.

A valuable portion of the address related to methods of getting business. Mr. Kimball divided the business tributary to every plant into three classes, the "spontaneous" business that comes unsolicited, the "obvious" business that comes by a certain amount of publicity, and the "latent" business that will come if systematic advertising and solicitation are brought to bear. He urged that an advertisement must call attention to definite uses that may be served by the application of electricity, and that these advertisements must be couched in terse, interesting language. Reading notices are also a valuable form of advertising. He suggested that several central-station companies, in as many small communities, employ an expert business getter and share the expense. Finally, the cultivation of a sense of co-operation and loyalty is essential. The last 5 per cent of an employee's energy is the really valuable part, he said.

A banquet in the evening closed the first day's festivities. On the day following a baseball game was played between a team of supply men and one from central stations. About 125 members and guests were in attendance.

Convention of the Pennsylvania Electric Association.

An account was published in these columns last week of the first day's session of the fourth annual convention of the Pennsylvania Electric Association at Exposition Park, on Conneaut Lake, Pa. When the convention closed on Friday afternoon, Sept. 8, there were 302 members and guests registered. Despite the lowering clouds which prevailed throughout the week, there was not enough rainfall at any time to mar the sessions on Thursday or Friday, nor to interfere with the entertainment program arranged for by the committee. Electric manufacturers and supply men were well represented; in fact, there were more of these registered than at any previous convention of the association. A brief account of the exhibits, with a list of the manufacturing companies and supply houses represented, is given elsewhere in this issue.

MOTORS.

The session on Thursday morning was opened with the reading of a paper by Mr. A. M. Dudley, of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., on "Motors." This was an elementary and didactic treatise, in which the author first described the different types of alternating-current and direct-current motors employed in industrial service, with their starting and controlling devices; then the characteristic curves of these motors, with particular reference to speed and torque, followed by a dissertation on the type of motor best fitted for some of the commoner applications, and concluding with a few general remarks on the relation of the central station to motors and industrial service. Diagrams of connections and engravings of starters and motors were scattered throughout the paper. The classification and nomenclature for motors adopted by the American Institute of Electrical Engineers were followed by the author, who pointed out that all design is a compromise, and that the best motor for service is one in which all the conditions are nicely compromised and the motor starts well and runs well. In discussing the alternating-current, wound-rotor type of variable-speed motors, the author stated that, while it is possible to run at any speed at will by merely inserting enough resistance, there are two very serious objections to operating a motor of this type at a reduced speed, either of which may be prohibitive for a given application. The first is poor regulation and the second poor efficiency. The author also called attention to one of the broad and elementary principles in industrial work in the application of an adjustable-speed motor, to wit, that one should not attempt to get variable-speed operation on individually driven machine tools by using a direct-current motor with

resistance in series with the armature, or by using a wound secondary induction motor with external resistance. The author drew attention to the fact that variable-speed motors must be used in connection with flywheels of all sorts, and added, as a second elementary principle, never to put a motor on a flywheel with less than from 8 per cent to 10 per cent drop in speed from no load to full load, the exact amount depending on the peaks in the load. As showing how this may be worked out and elaborated to a nicety in the case of flywheel-motor-generator equalizing sets, Mr. Dudley mentioned an instance of a motor of some thousands of horse-power which is reversed from full speed forward to full speed backward in four seconds. Hardly a tremor is felt at the generating station, because the motor speed is adjusted to decrease under the peak, whence the flywheel comes into effect. The paper closed with the following reasons for purchasing electric energy for driving motors in industrial plants: Continuity of service initially; expert consulting advice free on the initial installation and on operating performances; facilities for indefinite expansion; motor stock of the local central station to draw upon in case of breakdown or hurry-up installations; ability to run part of the establishment or run individual machines overtime without firing up the boilers for the whole plant, and interchangeability of apparatus with all the users connected to the same central-station service.

Discussion.

There was no very general discussion on the paper. Mr. W. L. Robertson, of Philadelphia, inquired as to the desirability of using a high-speed motor with high mechanical reduction, as against using a lower speed motor. Mr. Dudley stated that while a higher speed motor was usually lower in first cost it is well to stick to a moderate-speed motor, using conservative ratios of gearing. In answer to an inquiry of Mr. E. F. McCabe, of Titusville, as to the absence of a no-voltage release on auto starters, the author stated that a squirrel-cage induction motor up to 50 hp in rating would not be injured if the system to which it was connected was temporarily disabled and then started again. However, other circumstances might dictate the use of a no-voltage release in connection with an auto starter.

PRESIDENT GILCHRIST'S ADDRESS.

After the reading of Mr. Dudley's paper Mr. J. F. Gilchrist, the newly elected president of the National Electric Light Association, addressed the convention. In introducing the speaker Mr. Granger told of the strenuous time Mr. Gilchrist had in reaching the convention from Association Island, automobiles and a motor boat being pressed into service, in addition to the railroad, in order to effect the journey on time. Mr. Gilchrist confined his remarks to the functions of the National Electric Light Association. Of the nearly 10,000 members now enrolled in that body Mr. Gilchrist said that 1300 to 1400 of them were electric-lighting companies. The primary function of the association, he said, should be the protection of the electrical business generally. He gave as the secondary function the development of business and expressed the opinion that the papers read at the conventions constitute the most up-to-date literature in the industry. By acting as a clearing house of information for members the association, he said, fulfilled its third function, while its fourth function is to preserve the records of the electric-lighting industry. Mr. Gilchrist then took up the relations between the national and state associations, and outlined the functions and rights of each. He said that the best convention and committee work can be developed in the state organizations and intimated that a scheme is on foot for limiting the attendance at the national conventions, closing with a plea for an increase in the number of company sections.

Mr. T. C. Martin, the executive secretary, was scheduled for an address, but owing to preparations for a trip to Seattle Mr. Martin was unable to be present.

SERVICE CONNECTIONS.

A paper with the above caption was prepared by Mr. P. H. Bartlett, of the Philadelphia Electric Company, who described his treatise as a series of notes and comments on existing methods, in which certain points were emphasized which it was hoped would provoke some discussion tending toward a standardization of practice, in so far as is compatible with local conditions. As treated in the paper the service connection included all of the apparatus and connections between the transformers, secondary circuit or underground mains of the company up to the house side of the meter. In compiling the notes the author avoided making any recommendations or indorsing to any extent any particular practice, although he has quoted liberally from the rules of a company operating in Pennsylvania (the Philadelphia Electric Company), not from the viewpoint of indorsing these rules, but merely as a basis for argument and discussion. An endeavor was made to bring out certain points regarding which a diversity of opinion or practice exists and to cite their effect on the relations of the electrical contractor and the company, together with the methods by one company to overcome such difficulties as may arise in connection therewith. To this were added some brief specifications covering certain methods bearing directly on the subject matter of the paper, which the author hoped would be of use. On the presumption that what is justifiable in one city is, generally speaking, good policy in another the author suggested that the overhead-line committee of the National Electric Light Association should extend the scope of its work to cover these points or else that some separate committee should formulate some satisfactory standard practice which could gradually be worked up to in the future. It was realized that it might be impossible to formulate any set of rules or regulations covering service connection which could or would be wholly followed by all the member companies, even if indorsed by them.

Discussion.

The discussion on this paper was put over until Friday morning's session, in order that the remaining portion of the morning's session and all of the afternoon session might be devoted to the report of the committee on overhead-line construction. In opening the discussion on Mr. Bartlett's paper Mr. H. N. Mueller, of Pittsburgh, drew attention to the necessity of the company exercising supervision over the installation of the conduit and cable used in making the service connection, even though this part of the work was paid for and became the property of the consumer. In Pittsburgh 3-in. conduit is the smallest size permitted by the company and No. 6 the smallest wire used in the cable, the specification of which was as exacting as that used by the company itself. He questioned the desirability of compelling all installations exceeding twelve 16-cp lamps to be connected to a three-wire system, owing to the increased cost of the latter, and stated that in Pittsburgh as many as 100 lamps were permitted on a two-wire distribution system and that the variation in voltage on a three-wire network did not exceed 0.75 volt on one side of the system.

Mr. J. E. Pyle, of West Chester, drew attention to the fact that the author made no provision for a cut-out ahead of the circuit in the conduit to protect the rest of the system from a breakdown at that point. In West Chester it is the company's practice to install a cut-out for this purpose. Mr. E. F. McCabe, of Titusville, asked for information concerning the relative advantages of lead-covered cable over rubber-covered wire in conduit-service connections, intimating that the relative advantage of the cable over the rubber-covered wire was not sufficient to offset its increased cost. Mr. J. F. Cole, of Altoona, said

that his company used both cable and rubber-covered wire for service connections in conduits, ranging in size from ¾ in. to 2 in., and that it had no reason to regret the employment of rubber-covered wire instead of lead-covered cable in both the galvanized and inside-enameled iron conduit.

Mr. A. R. Granger, of Chester, then proposed a number of questions which it was desired that member companies should answer. The first of these had reference to the point at which the company's work ceases and the customer's work begins. Mr. E. B. Greene, of Altoona, stated that it was the practice in that city to stop the company's work at the outside of the building at the point of service entrance, but that the company is now planning to run all of the service connections up to the house side of the meter. Mr. E. L. Franklin, of Easton, said that in the latter city, where there were two competing electric-light companies, it was the custom of the older company to install the cut-out and meter; the customer, however, is required to bring the wires 2 ft. outside of the building to a point indicated by the company. Mr. G. E. Wendle, of Williamsport, said that it is the practice of his company to carry the service to the main cut-out, which is supplied by the customer.

In answer to the second question propounded by Mr. Granger, as to the proper location of the meter, Mr. F. M. Noecker, of Renova, said that his company places the meter in a cabinet flush with the outside wall on the side porch of residences and in the hallways of the first floor of office buildings, stores, etc. The advantages of this, he said, are that the service lines are always open to inspection, the wiring is not costly, the weather has little effect on the meter and the reader is greatly expedited in his work. At present 70 per cent of the meters in Renova are thus installed, and the meter reader averages 300 meters a day, as against 80 to 90 meters where the instrument is located in an attic, bathroom or cellar in the interior of the residence. At Renova the minimum rate for energy is 75 cents per month, and on the assumption that the meter reader receives 30 cents an hour, if a meter is located in the residence interior and circumstances are such that it necessitates two or more calls to effect a reading, the cost of the reading is greater than the revenue derived from the installation.

Mr. J. E. Pyle, of West Chester, said that in the latter place the service is run concealed to the meter, which is placed in the cellar. Concealed knob and tube work is usually installed at the time of the erection of the building for this purpose. Mr. H. Harris, of Wilmerding, told of the attempt of the Pittsburgh Booster Club to standardize specifications for wiring the ordinary type of building, in which the architect usually provides for a meter in a bathroom, and after a long discussion with the contractors of the city no definite conclusion was reached. Mr. E. B. Greene, Altoona, stated that his company first installed meters in the attics of residences, but since then the practice has changed, so that now they are being located in the cellar. To overcome the loss incident to repeated calls of a meter reader, when the meter is not accessible at the time a printed post card with a picture of the dial is left with the consumer, with the request that he indicate the position of the hands on the dial and mail the card, which is stamped and addressed. Ninety per cent of the cards thus left are returned, and the effect is salutary, inasmuch as the customer appreciates the confidence placed in him by the electric-light company in reading the meter for that month.

The third question asked by Mr. Granger dealt with the ownership of all the connections on the street side of the meter, and it was asked if a company could lawfully prevent a person from tampering with his own property on the service side. Mr. E. H. Davis, of Williamsport, stated that even though the consumer might own a part of the service connection on the street side of the meter he could not tamper with it, and that he would be just as liable for theft of energy from his own meter as from one which the company installed. Messrs. Greene, Wendle and Cole also spoke on this question.

The last question had to do with the recommendation of the author of the paper as to whether the subject was of sufficient importance to be intrusted to a separate committee, or whether the scope of the overhead-line committee's work should be enlarged so as to include the subject. By vote of the association the suggestion of the author was referred to the executive committee of the national association. Prior to the vote, however, Mr. Bartlett, in closing the discussion, replying to Mr. Pyle's criticism of the absence of a cut-out ahead of the conduit, said that experience with 10,000 to 15,000 such installations showed no serious trouble from this source. He also expressed the opinion that it was bad practice to run the service to a meter by concealed-knob and tube work, stating that in the rehabilitation of an old company he found 100 or more houses in which the lamps were connected ahead of the meter, due to the ignorance of the owner or contractor, neither of whom knew whether the wires tapped were service wires or distribution wires.

PRESERVATIVE TREATMENT OF POLES AND CROSS-ARMS.

The report of the committee on overhead-line construction was read in part at the morning session on Thursday and concluded at the afternoon session. The report was divided into five sections, not including a criticism by Prof. J. P. Jackson, of State College, Pa., on the preservative treatment of poles and cross-arms, and some additional data on sag and span calculations by Mr. William Le Roy Robertson, of Philadelphia. At the morning session Professor Jackson read his portion of the report, which constituted a résumé of the N. E. L. A. report and all bulletins of the United States Department of Agriculture concerning the preservative treatment of poles and cross-arms. His conclusions are: First, that the proper cutting and seasoning of poles prepare them for preservative treatments and reduce their weight in transportation. Second, preservative treatment is profitable financially, particularly so for the softer woods. Third, the preservative treatment enables the use of less expensive timbers. Fourth, the size of treated poles may be determined upon strength, with less reference to the question of decay. Fifth, the best preservative material is apparently coal-tar creosote, and is probably the most economical in the end. This is not intended to exclude the use of other preservatives under special conditions and where creosote oils are unavailable. Sixth, the high-pressure process is the most thorough. It, however, requires treatment of the whole pole, and is therefore more expensive. It is also frequently unavailable. Seventh, the open-tank process is quite efficient, and small plants can be erected at comparatively little expense. Eighth, the brush process, where the more efficient methods are unavailable, is advisable. Gains, roofs and other cross-cuts, where not otherwise treated, should have applications of the hot creosote oil by the brush process. Although practically all of the report had been given to creosote oils and their use, the author stated that other materials are also used, that in dry places zinc chloride has been found to give good service, and that in cases where better materials were unavailable tars have been used with some satisfaction.

Discussion.

Mr. Thomas Sproule, in opening the discussion, stated that the Philadelphia Electric Company uses from 250 to 400 new poles a month, so that any treatment would be expensive. Almost all of the literature devoted to the preservative treatment of poles is confined to the open-tank process, and Mr. Sproule said that it is almost impossible to get the company to make any appropriation for the preservative treatment of poles, owing to the lack of authentic information on the saving effected. Oftentimes it is neces-

sary to buy and erect the poles immediately, but it is the practice of the company to keep a two-year supply on hand, so that at least all of the poles have one year's seasoning. The company has been experimenting with the brush treatment for the past two years, and inasmuch as this treatment can be applied by even the smallest stations, Mr. Sproule suggested that energy be directed to securing all the information possible on this kind of treatment before the open-tank process is taken up.

Mr. H. N. Mueller, Pittsburgh, stated that with scattered pole yards the cheapest open-tank process would be expensive, since it would mean the duplication of equipment unless a portable process could be invented. Experience also shows, he says, that the brush treatment is useless unless the poles have been well seasoned.

Mr. W. C. Sharp, of Pottsville, stated that his company paints gains and butts by the brush process, but the treatment has not been practised long enough to enable accurate results to be obtained. Mr. E. F. McCabe, of Titusville, said that he had experimented with the brush treatment for three years, but without definite results. He felt that any method of pole treatment was too expensive for the average-size plant in Pennsylvania, and suggested that pole dealers be encouraged to erect such treating plants, from which the companies could purchase their poles. Mr. C. G. MacAvoy, Bellefonte, cited a case where poles treated some years ago were removed and found to be in good condition. Mr. E. B. Greene, Altoona, who had charge of the plant at the time these poles were erected in Bellefonte, vouchsafed the information that these were treated about twenty-six or twenty-seven years ago with boiled linseed oil and willow charcoal. Poles were also treated with tar from pine, and in not a few cases gas tar was employed. Seasoning poles for two years resulted in an increased life of 40 per cent, and Mr. Greene suggested that good results could be obtained by treating seasoned poles with dead oil.

Mr. S. C. Pohe, of Bloomsburg, called attention to the defects of the brush treatment, in that rain usually washed the creosote out. Mr. J. H. McDonald, of the Pennsylvania Railroad Company, stated that his company has established a large creosoting station at Mount Union, where ties were treated by the pressure method. Some old poles were also reinforced along the Philadelphia division. A tar-paper band was fitted about the pole and filled with 2½ in. of asphaltum to a point 6 in. above the ground. The pole remained dry under the portion treated, and the results are promising. The life of the pole thus treated is extended about five years, and the cost of the treatment is about $1.05 a pole. Mr. McDonald also described another treatment in which the decayed portion of the pole near the ground line is surrounded with a band and the space between the band and the pole filled in with a certain cement mixture.

Mr. E. F. McCabe, Titusville, said that he had treated poles with creosote at a temperature of 140 deg., whereas Professor Jackson suggested creosote at 200 deg., and he thought that owing to the volatilization of the oil the higher temperature was undesirable.

Mr. R. D. Coombs, of New York City, said that inasmuch as what practically corresponds to the brush treatment has been tried on bridges with excellent result the brush treatment of poles should prolong the life of the wood. Incasing a wooden pole in a concrete base was also fraught with good results, although in his estimation the creosote treatment was preferable and cheaper. Professor Jackson, in closing the discussion, said that it might be possible for a station to take any old tank at hand and fit it with some old coils for heating the creosote and by this means employ the open-tank method of treatment with fair financial results. In reply to Mr. McCabe's question he stated that volatilization of the creosote is not excessive under 205 deg., moisture being the chief ingredient passing off at that temperature.

SAG AND SPAN CALCULATIONS.

The first business of Thursday afternoon was the reading of the last part of the overhead line committee's report, devoted to sag and span calculations, by Mr. W. Le Roy Robertson, of Philadelphia. The question of sag and span was treated in a preliminary manner at last year's convention by the same author, and in the present paper an attempt has been made to give the proper sag and stress values to be used in the erection of overhead lines. The calculations are based upon a load of a ½-in. coating of ice, a wind velocity of 60 miles an hour, acting upon the wire surface only, and not on the ice surface; a temperature of 20 deg. Fahr. below zero, with an allowable stress not to exceed three-quarters of the elastic limit and a factor of safety of about 2.2. The data have been calculated with the aid of solutions presented in a paper entitled "Solutions to Problems in Sags and Spans" by the author, which appeared in the June, 1911, *Proceedings* of the A. I. E. E. Tables are given for No. 6 and No. 2 solid hard-drawn copper, with three-braid weatherproof covering, and No. 0000 stranded hard-drawn copper with three-braid weatherproof covering. Additional data are also given for annealed-copper wire with three-braid weatherproof covering, the data in the latter case having been calculated somewhat approximately. The sag values and the data on annealed copper differ from those given in the national report. There was no discussion on Mr. Robertson's contribution to the report.

OVERHEAD-LINE CONSTRUCTION.

The criticism of the report of the national committee on overhead-line construction was divided into five sections. Section 1 covers specifications for overhead-line construction for 2300-volt distribution and for street lighting and specifications for materials covering secondary-distributing systems. Section 2 covers specifications on methods of overhead-line construction for secondary voltages, including pole wiring for street-lighting work. Section 3 covers inter-company agreement forms and specifications for the joint use of poles by lighting and telephone companies. Section 4 deals with specifications for overhead crossings of electric lines. Section 5 is devoted to considerations of maintenance and inspection. The first and second sections were presented and elaborated by Mr. H. N. Mueller, of the Allegheny County Light Company, of Pittsburgh. Sections 3 and 4 were presented and elaborated by Mr. G. E. Wendle, of the Edison Electric Illuminating Company of Williamsport, and Section 5 was read, in the absence of Mr. W. C. Sharp, of the Eastern Pennsylvania Light, Heat & Power Company, of Pottsville, by Mr. F. M. Noecker, of the Renova Edison Light, Heat & Power Company.

Mr. Mueller called attention to the fact that the cross-sectional diagrams of cross-arms in the national report are marked 3½ in. by 4½ in., whereas the generally accepted standard, as established by electric-lighting companies, telephone interests and the various telegraph companies, is 3¼ in. by 4¼ in. He enumerated certain tests which he suggested should be made by the national committee, including the average wire-carrying capacities of the arms for spans of 150 ft., with specified sags; the weakening effect of bored pin holes; the comparative strength of arms when the arms are not bored and clamp pins are used and when standard bored arms using 1½-in. pins are employed. After such data have been obtained the committee feels that the national committee can then advisedly recommend the standard which can be taken up by the manufacturers of cross-arms and made commercially practicable. Objections were also made against certain of the specifications for wooden insulator pins, specifications for metal pins, specifications for copper wires and cable with weatherproof insulation, specifications for aluminum wires and cables with weatherproof insulation, specifications for rubber insulator tree wire braided and specifications for

methods of construction. With reference to the latter the committee is of the opinion that, while the meaning and intent of the term 2300 volts nominal are clear, in a legal sense it is limiting, and that the term be defined as covering operating voltages between the limits of 2000 and 3000. The committee also suggests that poles be numbered by means of metal stencils of either the cut-out or embossed type.

With reference to the second section covering methods of overhead-line construction for secondary voltages, including pole wiring for street-lighting work, the Pennsylvania state committee recommends that this section of the national report be eliminated, on account of the fact that the whole mode of secondary distribution is undergoing rapid change and development. The latest development in secondary-system construction, particularly for stringing secondary mains, differs so radically from the methods proposed that the committee believes it expedient to proceed slowly in adopting standards which may shortly be superseded. Furthermore, secondary-system work is so largely a matter of local conditions that no standards will be generally accepted. The Pennsylvania state committee again reiterates its criticism against connecting lightning-arrester ground wires to grounded neutral wires and asks that this be eliminated from the national report. The line of fixtures shown in the national report, the state committee claims, is poorly designed as regards the manner of fastening to the arms.

On the matter of joint use of poles the state committee believes that it would be well to distinguish between poles where permanent rights of occupancy exist and poles where attachments are by license and revocable. Where one company already has its line at a particular location and another company desires the joint use of the poles the committee suggests that the latter should pay its pro rata share of the annual maintenance and inspection cost of the poles and taxes and other expenditures peculiar to pole lines, so that where two parties use the pole line jointly each will be at one-half of the total expense. The company having the original line would be the actual owner and the other would receive permanent rights to use the poles. In order to avoid subsequent friction the parties to the joint-pole agreement should determine the space to be used on the poles by each, and these limits should plainly be set forth in the contract. Then in subsequent operation each of the joint users of the poles could construct as many wires and attachments as he wished. When the pole requires renewal the company owning the pole renews it at its own cost, but should one of the joint users of the pole desire additional space which would necessitate a higher pole or more expensive construction the applicant should pay for the additional cost for renewing with a higher pole or for the extra construction. In case the existing pole does not require renewal the applicant for the additional space shall pay the total cost of replacement of the existing pole by such higher pole. Where attachments are made under a license the charge therefor shall be independent of the number of wires actually attached, provided the construction is according to the specifications. In case an isolated pole is erected by the junior company co-linear with the poles and extending through and above the wires of the senior company the committee is of the opinion that the latter company should have the right to place cross-arms on the isolated pole and attach its wires thereto in a standard manner without any charge whatsoever for the attachments, provided the distance between the poles of the senior company on either side of the isolated pole does not exceed 150 ft.

Under the specifications for construction on poles jointly used the committee believes that the vertical clearance between wires should be 40 in., but does not consider it advisable to make mandatory any greater distance than can be maintained legally. Under the standard specifications for overhead-line construction the vertical distance between electric-lighting wires, except at junction poles, is made 24 in., the center to center distance between gains on the poles. The committee suggests that either the minimum clearance be made 24 in. or the mandatory feature be eliminated. With reference to the part of the national report dealing with telephone companies and specifying that a standard wooden cross-arm not less than 4 ft. in length shall be fastened at its center to the pole by the equivalent of at least two lag bolts, the committee points out that the standard method of attaching cross-arms is by through bolts and braces, and inasmuch as the cross-arm in question is to be used to stand on it should be fastened in the same manner as any other cross-arm. The committee also points out that at the present time there is a decided tendency to eliminate completely the running of conductors down on the surface of the pole, either by insulated supports, through ducts of solid insulating material or with the various forms of armored cable. A system of open wiring, by which the electric-light conductors are carried from the ends of the electric arm above and secured to special brackets attached to the telephone arm below, the wires being carried thereon to the lower position on the pole, is suggested as being worthy of careful examination in connection with the service to arc and incandescent lamps. The committee feels that this promises to prove a much safer and more satisfactory solution of the problem of bringing electric-light wires down through the telephone wires than is outlined in the national report.

The state committee objects to the entire specifications for overhead crossings of electric-light lines in the national report for the following reasons: (1) They require special construction of all electric-light wires (except trolley-contact wires) crossing over railroad right-of-way, tracks or lines of wires, regardless of the voltage carried by the crossing wires, and crossings constructed over telephone, telegraph or other similar lines when the electric-light and power wires carry over 5000 volts constant potential. (2) They are not definite in one important particular. (3) They require relinquishment of the legal rights of electric-light companies. (4) They require unnecessary clearances. (5) They require unnecessary and unduly expensive construction at wire crossings. (6) They require construction which is insufficiently tried and experimental. (7) They require sags which do not agree with the experience of operating light and power companies. (8) They do not cover the cases when electric-light wires are crossed over by railroad lines of wires, telephone, telegraph or other similar lines. (9) If adopted they will injuriously affect the legal position and liability of electric-light companies. In order to place this matter clearly before the members Mr. Wendle took up the objections seriatim and pointed out the clauses of the national report which he stated justified the objections.

The committee endeavored to obtain from the members of the national committee a direct answer to the following question: "Will the regular standard construction specified for 2300 volts nominal be accepted for wire crossings over railroad right-of-way, tracks or line of wires?" Mr. Wendle stated that the answers received did not indicate agreement among the members of the committee on this point and that the fact was apparent that a railroad company could if it so desired require special construction at all wire crossings for all voltages. The ambiguity of the wording of the paragraph relating to the methods of supporting the conductor at the poles or towers was pointed out and the inability to detail a practicable and commercial construction which would meet requirements. Much of this part of the report was devoted to the specified minimum vertical and side clearances called for in the national report, and the Pennsylvania state committee pointed out that an electric-light company has the right under its franchise to construct, maintain and operate wire crossings independently of any consent on the part of the railroad crossed,

the only obligation being to construct, maintain and operate the crossings with safe vertical and side clearances. The railroad has no greater rights over highways than other users, except to the extent of their special use. When private crossings are desired it was pointed out that the railroad may demand any type of construction and impose any conditions which it deems proper. The committee stated that examination of the specifications in the report generally fails to disclose any agreement on the part of the railroads throughout the country to permit private wire crossings, even if constructed in accordance with the specifications, and that in view of these conditions the members should not voluntarily limit their legal rights and impose upon themselves duties in clearances with regard to railroads which are not demanded by safe construction and are not legally enforcible. Exception is taken to the general demand that alternating-current circuits clear all existing wires not less than 8 ft., since the courts of Pennsylvania have held that a junior company could not be compelled to maintain a greater clearance at a crossing point than the vertical distance which the senior company maintains between its own wires of similar alternating-current voltage, which in the case cited was 24 in.

Objection is also raised to the relative clearances required for bare and insulated wires when used on direct-current, constant-potential circuits not exceeding 750 volts, the committee pointing out that commercial insulated wire after a few months' exposure to the weather has a doubtful insulating value, and that a clearance of 4 ft. with the bare and 2 ft. with insulated wires is not justified by operating experience.

In order to collect data on the question of the hazard at railroad crossings the committee submitted a list of questions to seventy-seven of the member companies in the association, and answers were received in full from seventy of the companies, or 90 per cent of the companies in the association, which control about 95 per cent of the poles. A summary of the replies is given in the report, from which it appears that the total number of wire crossings with special fastenings or protective devices is not over forty-nine, while the total breakdowns or interferences at these crossings were sixteen. Of these breakdowns five were caused by galvanized-wire cradles, ten were caused by special wire-clamping devices required by the railroads and one by a line constructed by the railroad across its tracks at too low a level. The companies reporting the fifteen breakdowns have removed the cradles and special clamping devices and substituted therefor the regular double-arm construction with standard insulators and ties, since which no trouble has been experienced.

The committee feels that the question of crossings is a very vital one. In Pennsylvania the courts have held that an electric-light company "must construct, maintain and operate its overhead wires with the highest practicable degree of care," which means that a company must do all that human care, skill and vigilance can suggest and must adopt the most modern appliances and methods in its construction. If the specifications for overhead crossings in the national report are the best, and if adopted will result in safer construction, then, the committee points out, a company is legally bound to use these specifications in its construction everywhere on its system. In a lawsuit involving overhead construction the specifications approved officially by the representatives of the industry would in the estimation of the committee be offered in evidence and be accepted on the point at issue. The burden of proof would therefore be placed on any company attacking such standards. Where the jurisdiction and control of the industry are delegated to a commission which has the right to specify overhead-line construction and materials, such a commission would most certainly make as its minimum requirements the specifications adopted by the National Electric Light Association. In view of the foregoing the committee asks why specifications should be adopted which will injuriously affect the legal position and increase the responsibilities of member companies, especially since these have not been thoroughly tested and proved in service and are not accepted as unquestionably the best and safest.

Discussion.

Mr. J. H. McDonald, of the Pennsylvania Railroad Company, called attention to the desirability of having standard specifications for railroad crossings. He said that the smaller companies were the worst to deal with, inasmuch as they could not command the best engineering advice. Mr. R. D. Coombs, of New York, a member of the national committee on overhead-line construction, said that many of the objections raised had to do with matters of policy. The national committee was particular not to state how a thing should be done, but what the companies should do, and it made every attempt to compile reasonable specifications.

Mr. J. H. Perkins, of Lancaster, drew from Mr. McDonald an admission that in all permits for crossings the electric-light company is forced to sign an agreement absolving the railroad from all damages in case of accident due to the presence of the wires at the crossings. This, Mr. McDonald said, was insisted upon by the legal department of the railroad, which felt that inasmuch as the railroad was invariably on the highway first it could dictate to subsequent users.

Mr. E. F. McCabe, of Titusville, also called attention to the clause in agreements with railroads whereby the latter could compel the removal of the crossing on demand. He pointed out that the railroad did not own the property and merely possessed a right-of-way, but that it was oftentimes expedient for the lighting companies to sign the agreements in order to effect the crossings without undue delay.

Mr. Thomas Sproule, of Philadelphia, stated that crossarms having a section of 3½ in. by 4½ in. were in general use among the larger companies. He was of the opinion that clamp pins would eventually come into general use and defended the national report in many points. He felt that some of the recommendations of the committee were weak, although he admitted that the report was the best state report ever presented. Mr. J. F. Gilchrist, of Chicago, stated that engineers of the Commonwealth Edison Company had examined the report and found it satisfactory to the company. He said the men on the national committee were well selected for the work and their deliberations represented the best judgment of the industry. While some features could doubtless be improved upon, he urged that the national report should be adopted, after which such changes as practice dictates could be brought about.

Mr. McDonald, answering the objections of the state committee to the specifications on wire and its fears that small companies could only obtain such wire as the market affords, stated that the Pennsylvania Railroad had specifications for all of its wires used and found no difficulty in finding a manufacturer to turn out the product for them.

Mr. E. H. Davis, of Williamsport, discussed the specifications from the legal viewpoint and claimed that no general changes should be made or standards recommended or adopted without the most careful consideration of the two main factors involved—greater safety and increased expense. He maintained that no mere experimental suggestions should be recommended as standards, and that due consideration should be given to the effect of proposed standards upon the smaller companies and upon special types of construction in many localities due to local conditions. He said that the final test of a proposed standard is its general acceptance by the industry. If it is untried, debatable or experimental it should be rejected until it proves its merit. He cited the prejudicial legal effect of doubtful, untried and expensive standards and called attention to the very important legal questions involved in the

relation of the electric-lighting industry to the telephone companies, competing lighting companies, trolley companies. steam railroads and other interests, including the state and municipality. He contended that no standards involving such other interests should be proposed without the fullest consideration of the legal rights of all parties in interest, and certainly the legal rights of members should not be surrendered and additional responsibilities imposed without their full knowledge and consent. He said that proposed standards based upon engineering data alone cannot do justice to member companies and to the other interests affected. In order to emphasize the importance of the questions at issue Mr. Davis considered the money value of the investment of the industry affected. He cited the United States report on commercial electric-lighting companies for 1907, which showed an increase of investment over the previous period in 1902 of about 100 per cent. Assuming that the present figures will be 80 per cent in excess of the report of 1907 Mr. Davis gives the gross income of all companies for 1911 as approximately $300,000,000. The cash investment, he claimed, would certainly be five times that, or $1,500,000,000, and likely much more. The cost of the distributing systems will average from 40 per cent to 50 per cent of the total investment, or range from $600,000,000 to $800,000,000, the major portion of which investment will be affected by the standards proposed. The accident branch of the business, Mr. Davis said, costs annually on a conservative estimate 1 per cent of the gross income, or about $3,000,000. How much the standards proposed in the national committee's report will increase the investment or the annual cost of maintenance on overhead-line construction can only be conjectured, but Mr. Davis maintained that it will certainly be large enough in the aggregate to justify the most careful scrutiny of the entire report before its adoption. So far at least as appearances in the report itself are concerned, Mr. Davis said this phase of the question was never considered by the national committee. Passing thence to a consideration of the expense that would be involved if Section 4 of the national report went into effect in the State of Pennsylvania alone, Mr. Davis said that the 1659 crossings over steam roads at a moderate estimate of $50 for each crossing would involve an expense exceeding $80,000 and that the increased legal liability could only be guessed at. If the same type of construction would be legally required over all highways the cost would run into millions.

Mr. L. H. Conklin, Warren, Pa., agreed with Mr. Davis that the legal side of the report should be given the utmost consideration. The discussion, which was quite spirited throughout, occupied the entire session, and at its close it was voted to refer the entire report of the state committee to the national committee, with the suggestion that it be considered in connection with the report of the national committee on overhead line work.

ELECTRICAL APPLIANCES.

The first paper read at Friday morning's session was prepared by Mr. E. B. Greene, of Altoona, Pa., on the value of electrical appliances to the central station. The paper was somewhat reminiscent in character. At Altoona a two-rate system of charging for electrical energy is in vogue, so that almost all the appliances obtain the advantage of the low rate, which is 4 cents per kw-hour. Mr. Greene called attention to the advantages of suiting a flatiron to the woman, recommending in the case of a quick worker an iron rated at approximately 10 volts below the standard voltage on the line, care being exercised to instruct her not to leave the iron on the circuit for any longer time than is necessary to heat it up for work. The Altoona company has met with phenomenal success in introducing the flatiron in that city. The company engages young men for the purpose of selling heating units and pays them at the rate of 50 cents each for each article sold.

Discussion.

Mr. H. P. Swayne, of Altoona, said that from July, 1910, to July, 1911, his company added to its already large heating load 2460 electric flatirons and 472 toasters. One hundred of the latter were given away through an advertising contest, by which means 300 more were sold. Mr. J. E. Schute, of Altoona, stated that the greater part of the irons and toasters were sold at the office, the women using the devices being the best advertisers. So great is the heating load that the peak on Tuesday occurs at 10 o'clock, and Mr. J. F. Cole, of the same company, stated that this oftentimes necessitated the employment of an extra man on Tuesday in the boiler-room and the starting up of an additional unit. Mr. Greene drew attention to some curves for seven consecutive days which were displayed on the wall of the convention hall, which showed that the heating load, which is greatest on Tuesday, also was apparent on Wednesday and even on Thursday morning.

CENTRAL-STATION SERVICE VS. ISOLATED PLANTS.

An excellent paper on this subject was prepared by Mr. T. E. Spence, of the Luzerne County Gas & Electric Company, Plymouth, Pa., and was read in his absence by Mr. W. C. Anderson, of that company. The author endeavored to show that the question of costs should not always be the deciding factor in favor of purchasing energy from central stations, but that the many contingent, or rather accruing, advantages are largely in favor of the central station and should be given due consideration in balancing the central-station supply against the isolated plant. The author showed that in order to keep pace with the advancement of the art a central station is forced to install modern apparatus, whereas the manufacturer cannot readily afford to replace his apparatus for newer types and must usually use his plant continuously until it is relegated to the scrap heap. Moreover, the manufacturer never knows how future trade conditions will affect his business. The latter may increase extensively, and in order to keep pace with this growth it would be necessary to install additional units, which usually results in a very undesirable type of plant, needing more attention, more repairs, etc. On the other hand, if his business decreases, he will suffer loss by reason of fixed charges. Mr. Spence also asks if it is not better, from an investor's point of view, to avoid investment in a power plant which if destroyed will cause greater loss, due to interruption of business, than the loss due to the destruction of the plant itself, which latter can be covered by insurance. He states that continuity and reliability of service should be given due consideration in balancing the central-station supply against the isolated plant, and, further, that whatever makes for continuity and reliability, at some sacrifice of economy and detail, may be installed and will ultimately prove of greater economy through the insurance of uninterrupted output. The central station is in business for the purpose of producing and marketing electrical energy. Its reputation for reliable service, consequently, must be safeguarded, and a complete shutdown is almost unknown. There is, moreover, sufficient reserve apparatus installed in the plant of a central station to permit one or more of its units to remain idle without crippling the service. Such is not the case in isolated plants. The author gives a most convincing demonstration of the efficiency of the central-station idea in that his company supplies energy to coal mines and breakers from a coal-burning central station located several miles from the mines. The plants in the anthracite region can purchase fuel for about $1.30 per ton or less, and the energy can be purchased by the large mines for 2 cents per kw-hour or less. At such a rate the mine operators, especially those with smaller holdings, find operation with central-station service more advantageous than by isolated plant, with cheaper fuel but heavy investment cost per unit of work done.

Discussion.

Mr. E. B. Greene, of Altoona, called attention to the fact that the main drawback in producing energy at the coal mines is the lack of water. His company supplies about 4500 hp to mines in the bituminous coal regions contiguous to Altoona. Mr. W. R. Kenny, Connellsville, Pa., told of the immense load which the West Penn Electric Company has in the coal mines in that section. Most of the mines there have abundant water supply, but the maintenance cost is so excessive that the central station can compete. Moreover, for mine operation electricity possesses advantages superior to any other form of energy. Mr. H. N. Mueller, Pittsburgh, Pa., spoke of the difficulty of dealing with consulting engineers, who usually find it advantageous for their clients to install isolated plants. Mr. Mueller also showed how municipal plants tie up the business development in towns in which they are located and how boards of trade and boosters for various localities manage to attract business with the assurance of abundant and cheap electric supply for manufacturing purposes. Mr. Anderson said that his company recently was able to shut down two municipal plants, giving in lieu of payment street-lighting service to cover the cost.

ORNAMENTAL STREET LIGHTING.

A paper on this subject was presented by Mr. C. E. Stephens, of the Westinghouse Electric & Manufacturing Company, of Pittsburgh, an abstract of which is published elsewhere in this issue. Mr. B. F. Fisher, Jr., of the Westinghouse Lamp Company, and Mr. Thomas Sproule, of the Philadelphia Electric Company, discussed this paper briefly.

RATES.

The last paper of the session was the report of the committee on rates, of which Mr. J. H. Perkins, of Lancaster, Pa., is chairman. The committee reviewed the report of the national committee so as to bring out as distinctly as possible its more important features. Passing thence to cost determination, the committee thought that to gain the confidence of the public in the fairness of central-station methods of charging and at the same time place central stations in a position unassailable on the part of commissions or other business-regulating bodies the central station must have schedules of rates to reach all classes of business, which should be public and as few in number as possible. These schedules, in the opinion of the committee, should be based on costs logically determined. An actual case was cited in which the expenses are proportioned to three elements of cost: Those that deal wholly or in part with the number of customers, those that deal with the demand or size of the installation, and those that deal with the energy delivered. The committee indorsed the plea of the national committee for uniformity in the form of rates and recommended that a vote be taken on the question of a minimum charge and of flat-meter versus differential-meter rate for residence lighting, and that the result of the vote be transmitted to the national association as a definite recommendation.

Discussion.

The discussion on the paper on rates was taken up in the executive session, so that the details are not open for publication.

ELECTION OF OFFICERS.

At the Friday morning session the report of the nominating committee was received, and on its recommendation the following officers were elected: President, Mr. R. S. Orr, Pittsburgh; vice-president, Mr. Van Dusen Rickert, Pottsville; secretary-treasurer, Mr. W. E. Long, Philadelphia. The three members elected on the executive committee, according to the provisions of the constitution, were Messrs. E. H. Davis, Williamsport; Duncan Campbell, Scranton, and S. C. Pohe, Bloomsburg.

Mr. R. S. Orr, the newly elected president of the Pennsylvania Electric Association, is superintendent of the Allegheny County Light Company, Pittsburgh, Pa. He has taken an active part in the association since its formation and has been among the foremost in advancing its interests. Mr. Orr was born Oct. 14, 1867, in Clarion County, Pa., and was educated in the public schools, Washington and Jefferson Academy and Washington and Jefferson College, receiving the degree of B.A. from the latter in 1891. For two years after his graduation Mr. Orr taught in the Washington and Jefferson Academy, leaving there to become principal of the Ninth Ward public schools of Allegheny. In February, 1904, Mr. Orr forsook teaching as a profession and became general contracting agent of the company with which he is now connected. So effective and aggressive was his work that within a short time he was made acting general superintendent and within less than a year general superintendent, a position which he has since filled with credit to himself and his company. Mr. Orr effected many improvements in the service and is the inventor of a method of reinforcing decayed wooden poles with concrete, used generally by telephone, railway and lighting companies throughout the country. He is a member of the Engineers' Society of Western Pennsylvania, American Electrochemical Society and an associate member of the American Institute of Electrical Engineers. Outside of the engineering profession Mr. Orr is a member of the University Club, Pittsburgh Athletic Club, Board of Allegheny School Controllers, a trustee of St. John's General Hospital, a director of the Ohio Valley Bank and one of the board of managers of the Woods Run Industrial Home.

R. S. Orr.

ENTERTAINMENT FEATURES.

As was the custom at previous conventions of the association, abundant entertainment features were provided during the week to occupy the time of the members and guests not required at regular sessions. While the convention was in session Wednesday morning the ladies played cards in the hotel parlors, and in the afternoon the delegates took part in track events, including a 100-yd. dash, a 50-yd. dash, a fat-man's race, a three-legged race and a sack race. The races were hotly contested and afforded no end of amusement. Following these events there was a baseball game between the central-station men and the supply men, and as a finale to the day's outdoor sports there were four horse races at the excellent track with which Exposition Park is provided. The track presented a holiday appearance, with the pennants of the association everywhere in evidence. The attendance included, besides those at the convention, about 2000 persons from the nearby country. Wednesday evening was given over to a theater party, the talent including headliners from the various companies represented. Motion pictures and a minstrel troupe from Pittsburgh furnished the bulk of the entertainment, the sallies of the latter being directed at some of the best-known members of the association. Following the theater party, at the invitation of the Westinghouse Electric & Manufacturing Com-

pany, the party boarded the steamer *Helena* for a moonlight sail on Conneaut Lake. Refreshments were served during the sail and an electric search lamp served in lieu of the moon. The food was prepared for the most part on electric stoves, chafing dishes, percolators, etc.

On Thursday morning the ladies were taken in automobiles to the fish hatcheries of the State, and in the afternoon they held a salmagundi on the hotel veranda. Bowling and rifle contests were provided for men during the afternoon, and in the evening a cotillon, led by Mr. E. L. Smith, of Towanda, was given in the dancing pavilion. Beautiful favors were distributed, and the evening's entertainment concluded with a cake walk. The Sons of Jove held a rejuvenation in the Japanese tea garden later.

On Friday morning there were bowling and rifle contests for the ladies, and in the afternoon the men engaged in boat races and swimming contests, the entertainment program closing with a balloon ascension. Attached to the balloon, which reached a height of approximately 6500 ft., was an immense pennant of the association. Abundant prizes were provided for the contestants, including chafing dishes, percolators, sewing-machine motors, irons, table lamps and many other electrical devices for the ladies and suitable prizes for the men as well. Mr. G. B. Muth, of Philadelphia, was chairman of the entertainment committee.

Wisconsin Commission News.

The commission has dismissed a case brought against the Lodi municipal electric-light plant. A petition alleged that the rates for electric service were excessive and that certain consumers were discriminated against in the matter of meter rentals. At the hearing the municipality contended that the rates were not high enough to guarantee a reasonable return. The testimony showed that some consumers owned their own meters, while others paid an annual rental on meters owned by the plant. This rental was not uniform, however. It also developed that the consumers who usually are metered were on the flat-rate basis. From an approximate estimate of the plant's earnings gained from the very crude accounting system in use by the municipality the commission was of the opinion that the present rates yielded a somewhat small rate of return and consequently this portion of the petition was dismissed. The decision stated in this connection that when meters are in general use and the plant accounts properly kept a revision of rates may be necessary. The practice of charging a meter rental was condemned by the commission and the order provided that all meter rentals now in force should be abolished and a minimum bill of 50 cents per meter per month substituted. The municipality is also ordered to acquire all meters now privately owned or pay to the consumer owning his own meter an annual rental of $2 per meter.

New York Commission News.

The commission has been requested by the municipal authorities of the village of Catskill to fix the price to be paid for street lighting under a new contract proposed to be entered into with the Schoharie Light & Power Company, the parties having been unable to reach an agreement. The Board of Trustees of the village submitted several lighting specifications to the company and is particularly desirous of securing reasonable rates upon thirty-five 200-watt lamps, fifty 60-watt lamps and 200 50-watt lamps. This plan contemplates the elimination of all arc lamps now used, with the consequent saving in cost of maintenance and without any necessity of a change in station apparatus The company has offered to light the streets of the village all night and every night as proposed in this plan for the period from the termination of the present contract to May 28, 1912, at the annual rate of $53.78 for the 200-watt lamps, $22.50 for the 60-watt lamps and $20 for the 40-watt lamps. These prices the village believes to be excessive and unreasonable and in turn has offered to the company a compromised price of 6¼ cents per kw-hour for such service. The company refuses to accept the compromise, and the village authorities, therefore, appealed to the commission to adjust the difficulty; the commission is also asked to request the company to continue furnishing light to the village under the same hour schedule and at the same price as at present until the matter is heard and determined.

The Public Service Commission, Second District, has instructed its counsel to commence actions to recover a penalty provided by law against twenty-two gas and electrical corporations for failure to file the annual report required by the commission for the year ended Dec. 31, 1910. The companies were given until Feb. 15 to file these reports, and repeated requests for reports from the statistician of the commission and its counsel since that time have been unavailing.

CURRENT NEWS AND NOTES.

NATIONAL ELECTRICAL CODE.—The new biennial edition (1911) of the National Electrical Code will be issued in about a month.

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N. E. L. A. MEMBERSHIP.—The present membership of the National Electric Light Association is 9570, an increase of 900 since the May convention.

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METRIC SYSTEM FOR MAGNETIC TESTING.—At the meeting in July of the American Society for Testing Materials the committee which submitted a report on a standard method for the magnetic testing of iron and steel used the metric system in the report, partly on the grounds that nearly all electrical work in this country is done, at least in part, by the metric system, and in the European countries universally so, and also because the European technical press entirely and the American technical press in great part use that system in articles dealing with magnetic quantities.

* * *

THE HORSE IN HOT WEATHER.—Mr. F. D. Pembleton, of the Public Service Electric Company, New Jersey, has compiled statistics showing that the loss of horses during the recent hot wave was 3752 in four cities alone, namely, New York, Chicago, Philadelphia and Boston, the respective figures being 1708, 1483, 351 and 210. The money loss was probably considerably in excess of $1,000,000. In commenting on these figures the editor of the "Question Box" of the *N. E. L. A. Bulletin* says that during the period of great heat manufacturers of electric trucks and vehicles were swamped with orders, but few of which could be filled.

* * *

MEETING OF EMPIRE STATE ASSOCIATION.—The annual meeting of the Empire State Gas & Electric Association will be held in the Engineering Societies Building, New York, at 10 a. m. on Friday, Oct. 6. The program will consist of the reports of numerous committees and discussions thereon. Several of the recent opinions of the Public Service Commission which are of particular importance and the question of the extent to which public-service corporations should enter into civic relations will also be discussed. The election of officers for the ensuing year will take place at this meeting. Those who attend the meeting will lunch together at the Engineers' Club during the noon recess.

Old-Time Telegraphers.—The Old-Time Telegraphers' Association and the United States Military Telegraph Corps held their annual reunion at Atlantic City on Sept. 5, 6 and 7.

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Output of Gasoline Automobiles in 1912.—It is estimated that the output of gasoline pleasure vehicles in 1912 will reach 210,000. The largest annual output in the past was 186,000 cars, which sold at an average price of $1,533.

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Milwaukee Section, N. E. L. A.—The Milwaukee Electric Railway & Light Company Section of the National Electric Light Association will hold a meeting on Sept. 25 or Sept. 26 at which Mr. O. M. Rau, chief electrician of the company and also the recently elected president of the section, will deliver an address on "The Distribution System of the Milwaukee Electric Railway & Light Company."

* * *

A Correction.—The following correction should be made in the article entitled "New High-Tension Transmission in Connecticut Valley," page 619, issue of Sept. 9. The final part of the first paragraph should read "and the consulting engineers of the undertaking were the former firm of Thomas & Neall, New York, represented throughout by Mr. N. J. Neall, of the Boston office." In the next to the last paragraph it is stated that the mills mentioned are shortly to double their capacity, which should read "double their demand." In the tabulation of costs the item "Engineering, including preliminary surveys, $16.10 per tower," should read "Engineering, including all surveys, $37.40."

* * *

Brooklyn Edison Library.—In keeping with its spirit of progressiveness the Edison Electric Illuminating Company of Brooklyn has opened a library in its main office building for the benefit of its employees. About 100 volumes relating to the industry, and the leading trade journals comprise the initial equipment. Among the present reference books are the proceedings of the National Electric Light Association, reports of public service commissions of various states, books on welfare work and various industrial questions, and a number of engineering and law books of interest to central-station men. Additions to the library will be made from time to time and it is planned to have a library that will be of interest and value to all progressive employees.

* * *

Central-Station Baseball News.—The baseball teams of the Philadelphia Electric Company and the New York Edison Company met at the Bronx Oval, New York, Sept. 9. The game, which was keenly contested, resulted in a victory for the New York Edison team by a score of 7 to 0. A dinner was provided by the New York Edison Company at the Park Avenue Hotel, and the participants were conveyed thence in automobiles after the game and spent a most enjoyable evening. The team of the Brooklyn Edison Company has also scored numerous victories this season, including a recent game at Baltimore. It is expected that the New York and Brooklyn teams will meet soon to try conclusions, which will practically decide the championship among the teams of the public-utility companies of Greater New York.

* * *

Coney Island Mardi Gras.—Over 300,000 persons were present each evening this week at the annual Mardi Gras festival at Coney Island, New York, one of the features of which was the electrical decorations. Amusement places were brilliantly ornamented with electric lamps and lamps were strung from curb to curb along the principal street; these arches extended for nearly twenty blocks and formed an effective setting for the fantastic parade that was held each night. As in past years, there were a number of illuminated floats in the parade, lighted by contact with the trolley service along the route. At Steeplechase Park, where the king and queen of the carnival were crowned, the decorations were particularly elaborate, and the lighting effect was enhanced by the rows of ornamental street lamps fronting the resort.

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St. Louis League of Electrical Interests.—An inaugural dinner was given by the St. Louis League of Electrical Interests at the Mercantile Club in St. Louis on the evening of Sept. 8. Eighty members were present, and they discussed plans for the coming season's work. The league has taken a leading position in the discussion of civic and industrial questions relating to St. Louis. It has installed recently five illuminated signs in as many Eastern cities calling attention to the advantages of St. Louis as a manufacturing center. The league will take part in the entertainment of President Taft on his visit to St. Louis on Sept. 23. The first of the noonday luncheons for the coming season will be held on Tuesday, Sept. 19. The meetings are held at the City Club and visiting electrical men are assured of a cordial welcome if they will make their presence known to any member of the league.

* * *

Convention of the Northwest Electric Light & Power Association.—The convention of the Northwest Electric Light & Power Association will be held at Spokane, Wash., Sept. 21 to 23, inclusive, at which the following papers will be presented: *Problems of Power Transmission and Distribution,* by Mr. J. B. Fiskin, Washington Water-Power Company; *Central-Station Publicity and Commercial Policy,* by Mr. W. B. Grambs, Seattle Electric Company; *New Business Methods for the Small Central Station,* by Mr. Arthur Gunn, Wenatchee, Wash.; *Legal Aspects of the Light and Power Business,* by Mr. N. W. Brockett, Seattle-Tacoma Power Company; *Methods of Accounting in Connection with the National and State Legislature,* by Mr. C. N. Huggins, Portland Railway, Light & Power Company; *Central-Station Problems, Line Extensions and Question of Meter or Flat Rates in Small Towns,* by Mr. A. C. McMicken, Portland Railway, Light & Power Company; *Meter Accuracy in Relation to Central-Station Increase,* by Mr. Thatcher, Seattle Electric Company; *Electric Heating and Kindred Uses of Electricity,* by Mr. F. F. Barbour, Portland Railway, Light & Power Company. Mr. N. W. Brockett, Cataract Building, Seattle, is secretary of the association.

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Commonwealth Edison Section, N. E. L. A.—The first meeting of the Commonwealth Edison Company Section (Chicago) of the National Electric Light Association since the summer intermission was held in Handel Hall on the evening of Sept. 5 with an attendance of 311. Mr. Ernest F. Smith, the chairman, who presided, announced that the present membership of the section is 1264, an increase of 160 per cent since Nov. 1, 1910. It was also announced that the nomination ballots, which have been mailed to all members, must be returned to the secretary, Mr. E. J. Doyle, before the close of business on Sept. 30. These are primary ballots and the persons receiving the highest number of votes and the next highest number for each office will be voted on at the final election. The annual banquet of the section will be held about Nov. 1. Mr. O. J. Bushnell, superintendent of the meter department, read an interesting paper entitled "Turning the Company's Product Into Cash." It related to meter reading, billing customers and making collections. After an intermission some excellent instrumental music was given by five members of the N. E. L. A. orchestra, and the meeting concluded with a moving-picture show given by Mr. C. F. Stark, of the advertising department.

GEORGIA'S GREATEST POWER DEVELOPMENT.

Water-Power Generation and Distribution for Industrial Plants in the New South.

ALMOST within a stone's throw of the point at which Gen. William Tecumseh Sherman with his troops crossed the historic Ocmulgee River on his memorable march from Atlanta to Savannah, Ga., in the troublous days of 1865 there now stands the largest hydroelectric development in Georgia, one of the most modern of its size and kind ever built. Even to the layman this plant of the Central Georgia Power Company offers a striking example of the thrift, enterprise and rapid development of the New South.

In the *Electrical World* of April 27 this year an account of the generating station and transforming substations was given. The present article relates more particularly to the hydroelectric features of the development, giving additional data on the plant equipment and methods of operation, with special reference to the market for the electrical energy developed.

Like the Savannah, the Chattahoochee and other rivers in Georgia, the Ocmulgee rises in the mountains and on the Piedmont plateau and flows in a succession of rapids until it comes to its fall line. Like the other rivers, the fall of the Ocmulgee also occurs within the distance of a comparatively few miles of its course.

All of these Georgia rivers are subject at intervals to extreme droughts as well as great floods, causing a very wide range between minimum and maximum flow, but since the Ocmulgee possesses in a high degree natural features permitting the storage of great quantities of water in reservoirs it can readily be used for the development of power.

HYDRAULIC FEATURES.

The point of development utilized by the Central Georgia Power Company is midway between the cities of Atlanta and Macon, Ga., which are about 100 miles apart and between which the Ocmulgee River undergoes a fall of some 527 ft. The exact site is at the foot of Capps and Lloyds Shoals, immediately below the point at which the Ocmulgee is formed by the confluence of the South, Yellow, Alcovy and Tussahaw Rivers, as shown in the accompanying map, Fig. 4.

The dam is erected between two high bluffs in a narrow neck of the river. Both bluffs and river bed are of solid gray granite, constituting an admirable foundation for the dam and its abutments.

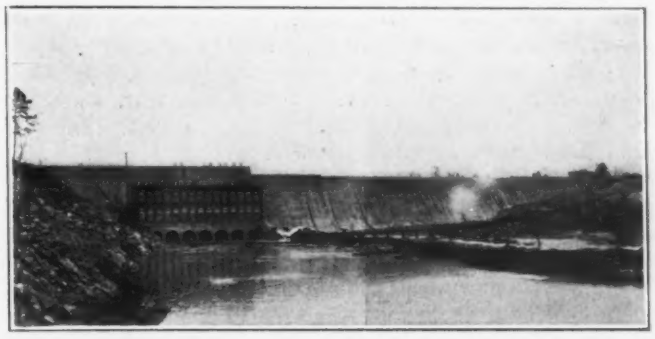


Fig. 2—Water-Power Development of Central Georgia Power Company at Lloyds Shoals, Ga.

As will be seen clearly from the map, Fig. 4, the union of the four streams mentioned affords a storage reservoir which consists of a large main body of water with the beds of the several streams forming, as it were, extensive arms, thus giving a far greater storage and volume of water than would be afforded by damming a single stream. It is doubtful whether there exists elsewhere in the South a water-power site combining these valuable features to the same extent. The creation of the reservoir resulted in backing up the water in the streams above the dam to a distance of about 15 miles.

The surface area of the reservoir is about 4000 acres and it is estimated that it contains upward of 7,000,000,000

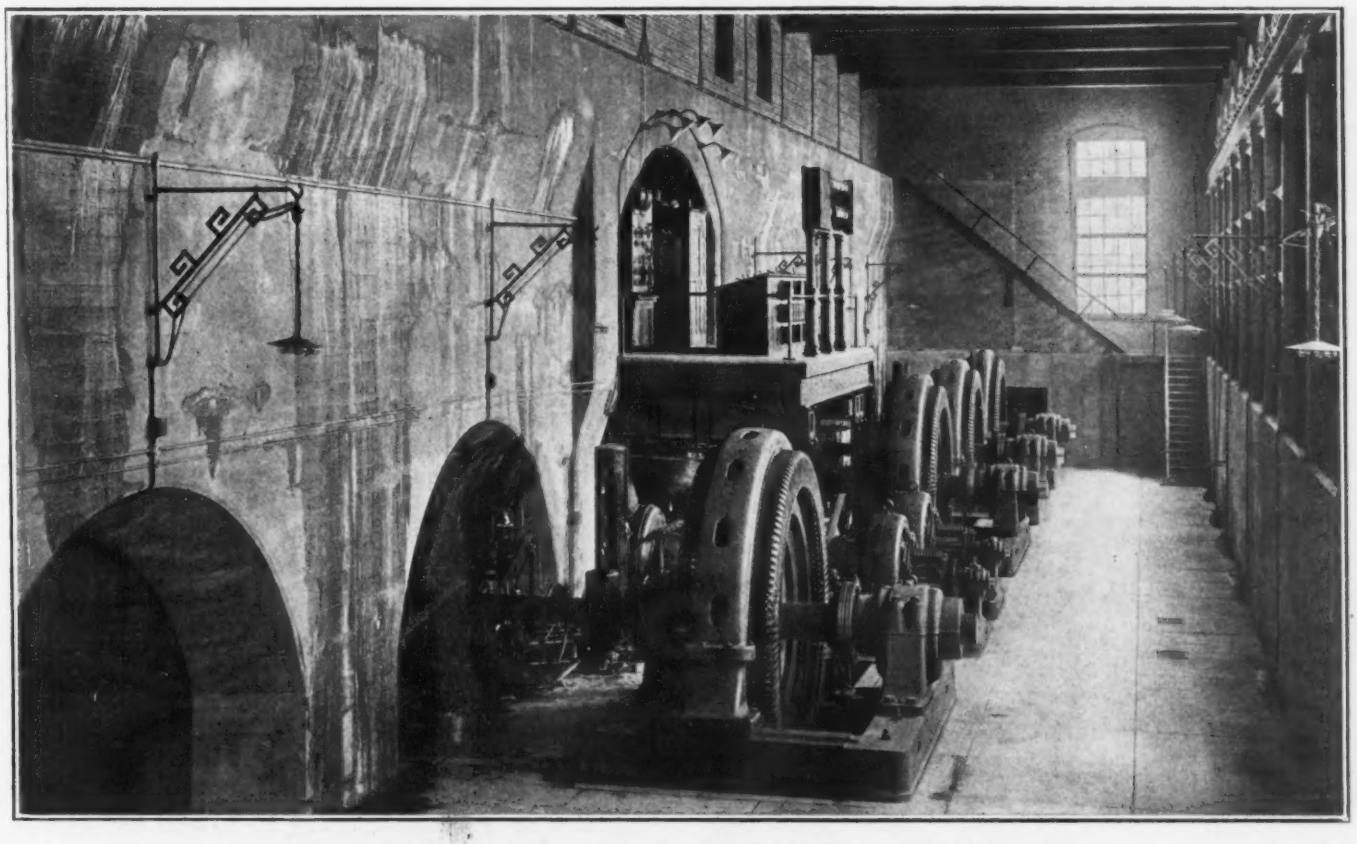


Fig. 1—Interior of Station, Showing Initial Installation of Four Generators.

cu. ft. of water. The storage area serving the reservoir is about 1350 square miles, while the discharge at the dam averages about 1800 cu. ft. per second. Like other similar reservoirs, that on the Ocmulgee River has already proved its value from the standpoint of practical conservation in that it regulates the flow of the river and is admitted to be of inestimable value alike to water users and property located below the dam.

All timber and underbrush in the area covered by the reservoir was cut and thoroughly burned before the water level was raised, as a precaution against fever or other illness arising from the creation of the reservoir. In order to secure the greatest possible storage area it was also found necessary to flood public roads at several points above the dam, as the result of which ten highway bridges, consisting of steel trusses on concrete piers, had to be constructed. These substantial bridges replaced flimsy old wooden structures which were usually flooded and, therefore impassable in times of high water. Thus the reservoir has also been a distinct benefit to the "good roads" movement in central Georgia.

The dam, a photograph of which appears in Fig. 2, measures at its crest 103 ft. above the surface of the water in the tailrace. It is constructed throughout of cyclopean concrete—large blocks of stone, forming about one-fourth of the entire mass, being embedded in a concrete mixture of cement and broken stone, the latter in the proportion of one part of cement, three parts sand and six parts broken stone, with the proper quantity of water. In all, 160,000 cu. yd. of masonry entered into the dam and abutments. The dam is 11 ft. wide at the crest and 95 ft. wide at the extreme base of the spillway, which is formed on a curve to take the water downstream in an absolutely smooth flow. The masonry section of the dam between abutments is 1070 ft. long, the east abutment 540 ft., and the west abutment 100 ft., making the total length 1710 ft. The power house, which is integral with the dam, is 200 ft. long, while the spillway occupies 728 ft. of the dam.

It is a matter worthy of note that the only imported material entering into the construction of the dam proper was the cement, fine sharp sand for the making of concrete being found in abundance in the channel of the river immediately below the dam, granite being quarried from the banks and bed of the river, and all the timber required in the construction of cofferdams, railways, etc., being cut

Fig. 3—Second Floor, Showing Transformers and Oil Switches.

from lands which were subsequently to form the storage reservoir.

POWER HOUSE.

The power house, shown in Fig. 2, is a brick and steel structure, 200 ft. x 45 ft. in plan, the walls of the first floor being 20 in. thick and those of the second floor 16 in. thick. The floors are of reinforced concrete, carried on steel beams, while the roof is of similar construction covered with five-ply tar paper and gravel. The plant is designed for six main generator units connected to water turbines. Four of these 3000-kw alternators are already installed, and it is the intention of the Central Georgia

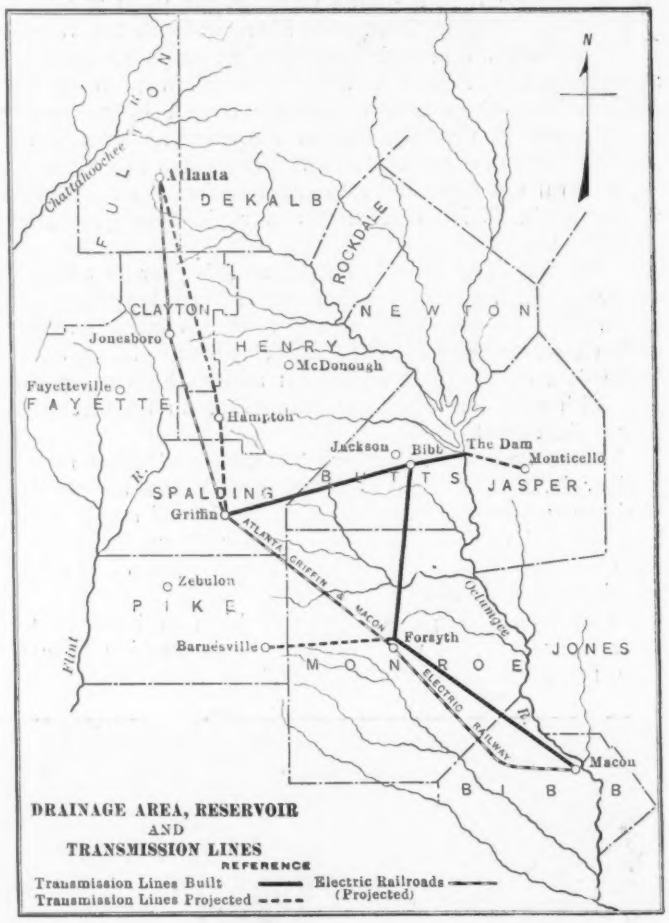


Fig. 4—Map of Drainage Area, Reservoir and Transmission Line.

Power Company to install the two remaining units at an early date.

Cross-sections of the power house, showing the relative location of the dam, penstock, draft tubes and general arrangement of apparatus, were given in the preceding article. As there pointed out, the generator equipment is installed on the main floor, while the high-tension switching apparatus and transformers are on the upper floor. The operating switchboard is placed on a gallery immediately over the exciter units on the main floor.

The hydraulic equipment throughout was furnished by the S. Morgan Smith Company, of York, Pa. The generator turbines, which are of the twin wicket-gate type, are 39 in. in diameter and are designed to develop 5500 hp each. Each generator unit is governed by a 30,000-ft.-lb. motor-controlled Lombard governor. The two exciter turbines, which are of 535-hp rating, are equipped with Woodward governors and are directly connected to two 400-kw generators. These exciter sets are located in the center of the station, the intention being that one exciter shall serve the three generators located in the east half of the power house, while the other shall serve the other three generators in the west half.

The chambers containing the waterwheels, and also the short penstocks which admit the water, are built in the dam.

The electrical equipment of the Central Georgia system was furnished by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. In the power house there are four 3000-kva, 60-cycle, three-phase, oil-insulated, water-cooled transformers. The high-tension voltages

available from these units are 38,100, 36,945, 35,790 and 34,635 volts delta, giving 66,000, 64,000, 62,000 and 60,000 when star-connected, the low-tension ratings being 2300, 2200, 2100 and 2000 volts delta.

As shown in Fig. 5, each generator circuit is led to a 1200-amp, 2300-volt solenoid-operated automatic overload

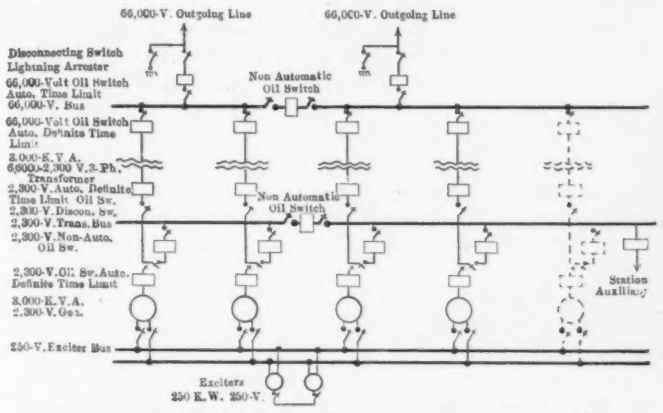


Fig. 5—Simplified Circuit Diagram of Power-House Wiring.

circuit-breaker, equipped with definite time-limit relays. Under normal operating conditions each generator feeds directly from this point, through disconnecting switches and a circuit-breaker (similar to the one above described), to the low-tension side of the three-phase transformer, which steps the pressure up to 66,000 volts. Between two sets of disconnecting switches a tap is taken off to another set of disconnecting switches and circuit-breaker leading to the 2300-volt busbars or transfer bus. With the aid of this arrangement any generator can be connected by the operation of the proper circuit-breakers to feed through to any step-up transformer. From the high-tension side of the transformer the circuit is led through a 300-amp, 66,000-volt oil circuit-breaker and thence through oil-immersed choke coils and disconnecting switches to the 66,000-volt busbars.

From the busbars the energy is taken to the substations over either one or both of two feeders, each of which is rated to carry 18,000 kw. These feeder circuits pass through automatic oil circuit-breakers and disconnecting switches and are protected by electrolytic lightning arresters with horn-gap disconnecting switches.

The 2300-volt and the 66,000-volt buses are thus divided

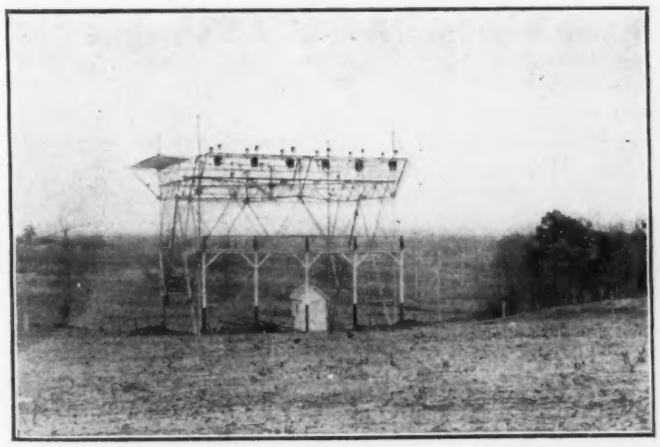


Fig. 6—Branch-off and Sectionalizing Tower at Bibb.

into two sections, each section being connected to one feeder. The bus sections can be tied together, however, by sets of disconnecting switches and non-automatic oil circuit-breakers. The 2300-volt tie switch is rated at 2000 amp and the high-tension breaker at 300 amp. The oil circuit-breakers are erected in structures of masonry, each pole being entirely inclosed in a separate fireproof compartment and each line terminal being separated by soapstone barriers from adjacent terminals.

The 66,000-volt wiring, following the latest engineering practice, is all open, consequently no inclosing struc-

Fig. 7—Griffin Substation.

tures are provided either for the circuit-breakers or the busbars. The 2300-volt wiring, on the other hand, is inclosed, the busbars, circuit-breakers and disconnecting switches being incased in masonry work.

The 400-kw, 250-volt exciters are controlled from one panel of a black marine-finished slate switchboard containing the switches and indicating meters. This switchboard also contains, in addition to a panel for each exciter, one for the control of the station lighting and motor circuits, the panel carrying a 2300-volt, automatic-overload, hand-operated, oil circuit-breaker and three two-pole single-throw knife switches.

The main switchboard is of the desk-type control, equipped with a complete set of mimic busbars installed on the top of the control desk, enabling the operator to tell at a glance the connections that have been made by the positions of the electrically operated switches. This board has been designed for the control of the four 3000-kva, three-phase generators and transformers, with provision for two spare sets of each, and also the two 18,000-kva, 66,000-volt feeder circuits. The top of the control desk is of slate slabs, the sides, front and rear being of steel plate in the form of removable panels, so arranged as to provide

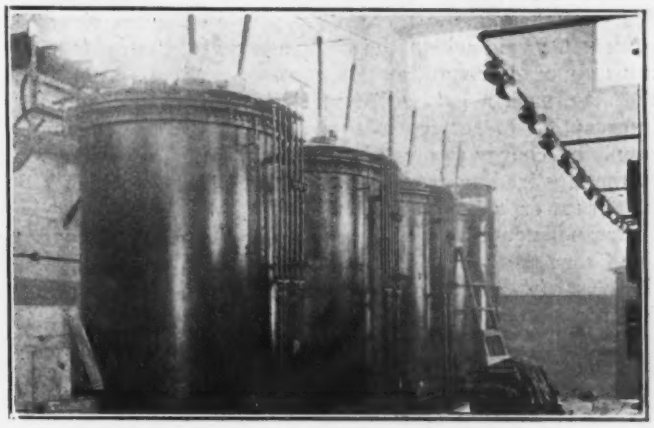


Fig. 8—Transformers in Macon Substation.

ready access to the interior of the bench for inspection and adjustment.

All circuit-breakers in the station, except that on the station lighting panel, are electrically operated, being manipulated from the control desk by drum-type controllers mounted thereon. The operating handle and dial plate are on the top of the bench, the contactors themselves

being mounted inside, so that there is no possibility of the operator coming in contact with even the 250-volt auxiliary circuits. All of the instruments and synchronizing devices are operated through series and shunt transformers, so the operator can by no chance make contact with any live circuits.

In addition to the usual red and green oil-switch position lamps the positions of the disconnecting switches are shown by two miniature 10-volt lamps connected in series, one being mounted on the control desk and connected in the mimic bus and the other mounted near the disconnecting switches. These lamps are fed from the 10-volt secondary of a small transformer and the lamp near the high-tension switch has connected in parallel with it a snap switch. When the attendant opens a disconnecting switch he turns the snap switch, thus short-circuiting the adjacent lamp and causing the lamp in the mimic bus with which it is in series to burn at full candle-power. This arrangement indicates to the operator that the disconnecting switches are open.

Complete sets of synchronizing plugs and receptacles are included in the generator sections. The closing circuits of the oil circuit-breakers are so wired that the breakers cannot be closed unless the synchronizing plugs are in their receptacles.

A full complement of indicating instruments of the vertical, edgewise type is included in the equipment. The instruments are mounted on a framework back of the control desk, being so placed that the operator facing the generator room when standing in front of the desk can look above the top of the desk and underneath the instrument frame to observe the operation of the machines. Watt-hour meters are installed on the rear of the control desk. Each section of the control desk is 18 in. wide, 32 in. long on top, 36 in. high in front and 44 in. high in the rear.

TRANSMISSION LINES.

As shown on the map, Fig. 4, the main transmission line extends 6 miles from the dam to Bibb, at which point it branches, through a switching tower, 41 miles to Forsyth and Macon on the south and 18 miles to Griffin on the north. The system as thus far completed comprises 65 miles of line and reaches only the cities of Macon, Forsyth and Griffin, but it is understood that these lines will be extended to Atlanta in the very near future. It is also the intention to extend the system from Forsyth to Barnesville and thence to Griffin, thus completing a loop which will constitute the center of the system and into which will be fed energy from the three other plants on other rivers in central Georgia which the company contemplates developing as market conditions warrant. As will be seen from the map, such a loop will materially lessen the chances of interruption to service in that it will provide a means of supplying energy to any of the cities mentioned over either of the legs leading from the switching tower at Bibb. This switch tower is shown in Fig. 6.

Arrangements have also been made to extend a separate line from the power house, over the top of the dam, to the city of Monticello, on the east side of the river at a distance amounting to about 9 miles from the site of development.

The transmission towers, which were furnished in part by the Riter-Conley Company, of Pittsburgh, Pa., and in part by the Milliken Company, New York, stand 80 ft. high from the ground to the pinnacle of the ground-wire support. They are anchored at each of the four corners, each anchor being required to stand a strain of 30,000 lb. without failure. The insulators were furnished by the R. Thomas Company, East Liverpool, Ohio. The tops of the lowest insulators on the towers are 50 ft. above the ground level.

The towers are located with reference to the contour of the country, but average about 500 ft. apart. The conductors are sagged between the towers to a point at which the resultant tension is minimized. These sags average about 25 ft. at the center, but in no case do the lines drop within less than 20 ft. of the ground. The clearance between line wires is 7 ft. 6 in. A copper-clad steel ground wire is carried on the center pinnacle and grounded at each tower.

From the dam to the switching tower at Bibb the lines are of No. 2-0 B. & S. gage copper, while from this point to the cities mentioned aluminum wire, equivalent in section to No. 0 copper, is used. The general design of the line was very carefully worked out with a view to eliminating the troubles common to high-voltage systems. The transmission line right-of-way is owned by the company. It is 100 ft. wide and was entirely cleared of standing timber before the construction of the line was entered upon.

On the transmission towers telephone circuits have been installed, the wires of which are so transposed as to insure good voice transmission. The telephone lines are also carefully protected against lightning discharges. Substantial booths with permanently installed telephone instruments are located at many points along the transmission line, while at other places drop connections are provided so that the line patrolmen, all of whom carry portable telephone sets, may have ready communication with headquarters at all times. In addition to this private telephone system the company's power house, branch station, substations, etc., are all connected to the lines of the Southern Bell Telephone & Telegraph Company, so that the prospects of total interruption to telephone service are very remote.

SUBSTATIONS.

Fig. 7 shows a view of the station at Griffin, in the background being seen one of the cotton mills which have contracted to use service from the company's lines. Except for slight differences this station is similar to that in Forsyth.

The buildings are all of brick and steel construction with concrete floors and foundations. The roof, which is of timber with tar and gravel covering, is carried on steel trusses and is surmounted by a steel tower into which are led the incoming high-tension lines from the power house. These lines are equipped with electrolytic lightning arresters and horn-gaps. In Fig. 8, on the preceding page, are shown the interior lay-out and electrical equipment of the Macon station.

Four 1500-kva, 60-cycle, single-phase, oil-insulated, water-cooled transformers are installed in the Macon station, transforming from 63,000 volts star down to 6600 volts delta. The four Griffin transformers are 750-kva units of the same type.

In the Forsyth station there are four 200-kva, single-phase, oil-insulated, self-cooled transformers of the core type. Like the preceding units, the high-tension side is wound for 36,400 volts and insulated for star connection to give 63,000 volts, while the low-tension side is wound for 6900 volts.

The high-tension lines are carried up through the roof of the station through porcelain insulator thimbles set on concrete cones, and thence through disconnecting switches to the high-tension feeder oil switches located on the floor opposite the transformers. A bus tie line connects the two feeder lines.

DISTRIBUTION AND MARKET.

As the Central Georgia Company is distinctly a wholesaler of energy, service is delivered to its customers at a pressure of 6600 volts. The consumer in all cases constructs a small brick or concrete compartment for the accommodation of his transformers and protective devices. To standardize such installations, as well as to conserve the mutual interests of the consumer and the company, the latter has drawn up a standard set of specifications setting

forth the company's recommendations as to the general character and the minimum apparatus which the consumer should install in his transformer station. Copies of these specifications are furnished to the prospective consumer, together with plans showing suggested design of the station and layout of apparatus therein.

In the case of large motor users a consulting engineer is usually retained by the customer, but for smaller consumers, who do not or cannot afford to retain an engineer, the company lays out the work. For this purpose the company retains skilled engineers, who are always available to aid the consumer with his electrical equipment.

The market for energy in central Georgia is a very fertile one. The business offered is of a much more desirable nature than that obtained in many other localities, for whereas in many sections of the South the motor business consists of some single industry, such as cotton mills or furniture factories, the business that presents itself in the central part of Georgia is of an extremely diversified nature, consisting of cotton mills, knitting mills, cotton-seed-oil mills, wood-working mills, railway plants, fertilizer plants, breweries, flour mills, brick plants, packing plants, etc., etc. As can be readily appreciated, with this varied class of business offering, the company is in a position to build up a very favorable load factor.

An important feature about the development is the fact that although the plant has been in operation only a comparatively short time contracts have already been written

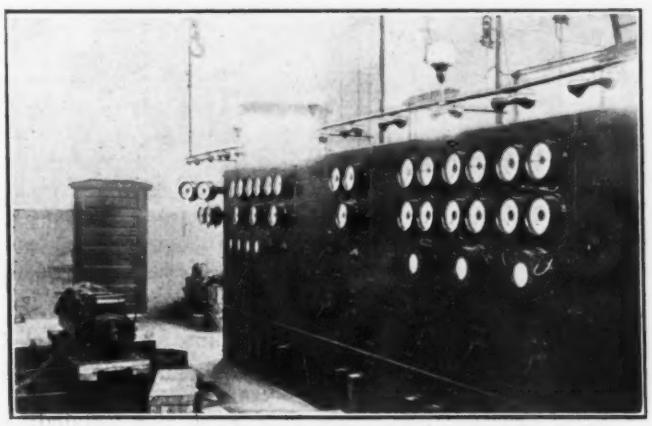


Fig. 9—Switchboard in Macon Substation.

for more than 10,000 hp, most of which is already connected and being served from the system. Indeed, it is expected that before the end of the present year the business written will require the installation of the two remaining generators in the power house and doubling of the transformer equipment in the substations.

Lockwood, Greene & Company, of Boston, Mass., were the consulting engineers for the Central Georgia Power Company; J. G. White & Company, of New York and London, acting supervising engineers in the construction of the system.

The organizing and systematizing of the various departments of the company, as likewise many of the special features of the plant, were due to its first general manager, Mr. J. J. Cagney, who remained with the company for some time after the successful starting up of the plant and subsequently resigned to accept the management of the Wawaitin Falls power plant, which is now being constructed on the Mattagami River in Ontario, Canada, to supply the demands of the numerous mines and towns in the Porcupine gold district. Since Mr. Cagney's removal the plant of the Central Georgia Company has been operated by the remaining officers of the company, who are: Mr. W. J. Massee, president; Mr. O. A. Farrar, assistant to the president, and Mr. L. H. Marrotte, general superintendent.

LIGHTNING ARRESTER INSTALLATION OF PITTSBURGH RAILWAY SYSTEM.

By TERRELL CROFT.

NEAR the western portal of the Mount Washington street railway tunnel the Pittsburgh (Pa.) Railways Company has erected a substation. Because of its location it is known as the Tunnel Station, and three syn-

Fig. 1—Tunnel Substation, Showing the Location of the Lightning

chronous motor-generators, having an aggregate rating of 3500 kw, are housed within the structure. These receive three-phase current at 11,000 volts, 60 cycles, and convert it into 600-volt direct current, which is distributed to railway circuits. Two sets of transformers are located in one end of the station, which raise the incoming pressure from 11,000 volts to 15,000 volts for a transmission line. In Fig. 8 is given a diagram of the essential connections and apparatus in the substation.

Electrolytic lightning arresters protect the high-tension incoming and outgoing transmission lines and carborundum block arresters protect the 600-volt railway feeders. All of the arresters are located on the roof of the substation, as shown in Fig. 1. It is with these lightning arresters, their arrangement, accessories, installation and operation, that this article will mainly deal.

Two 11,000-volt, three-phase, ungrounded-neutral, 60-cycle transmission lines enter the substation and each is protected with a Westinghouse type A electrolytic arrester. These two arresters are designated in the illustrations ac-

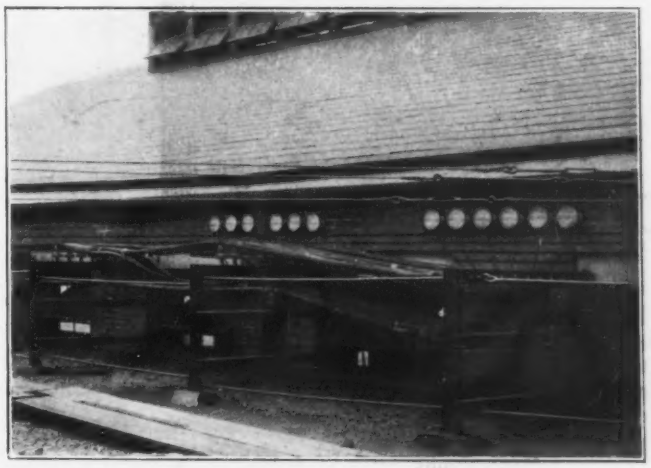


Fig. 2—Structural Steel Supports for Outgoing Trolley Feeders.

companying this article by the letters *C* and *D*. The 11,000-volt wires are brought to the station on a wooden pole line (Fig. 1) and are terminated on a structural steel frame on the roof of the station, which is shown in Figs. 3

and 4. Choke coils are inserted in the line wires just outside of the station, as shown in Figs. 3 and 4. The termination structure is conveniently located, between the arresters and the choke coils, so that taps from the line wires can be readily carried to each. The line wire taps

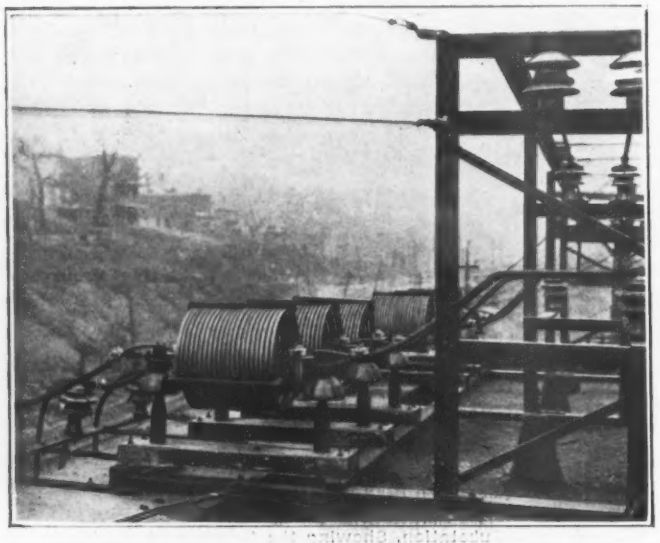


Fig. 3—Structural Steel-Line Wire Supports and Choke Coil Mountings.

from the choke coils are connected to the latter through lugs and, as an auxiliary connection, jumper wires are clamped around the choke coil terminal castings with improvised clips. These clips are pieces sawed from the clamps of high-tension termination insulators. The clips and the method of their application are illustrated in Fig. 3.

In Fig. 5 is given a connection diagram for each of the 11,000-volt arresters. Because of space consideration it was the desire of the operating company that all electrolytic arresters for the station be installed out of doors. However, the horn-gaps on the arresters described were given the standard indoor spacing for 11,000 volts, ⅜ in., and no trouble has been experienced due to their being short-circuited by rain or snow. The arresters have been in service for over a year.

Electrolytic arrester groups, designated as *A* and *B* in

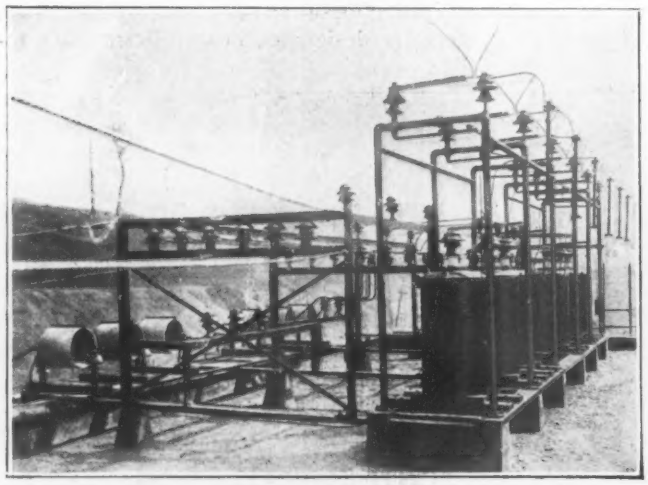


Fig. 4—Electrolytic Arrester and Choke Coils Before Any Connections Were Made.

the illustrations, protect a 15,000-volt ungrounded-neutral line. At present the two groups of outgoing wires from the arresters are both connected to the 15,000-volt line, just outside of the station, as shown in Fig. 8. Fig. 6 shows the connections of each of the 15,000-volt electrolytic arresters *A* and *B* and their choke coils. In Fig. 9 constructional details of the supporting structure are shown. The horn-gaps of the 15,000-volt arresters are given a setting equal to the diameter of a 5-cent piece, or a trifle over 13/16 in.

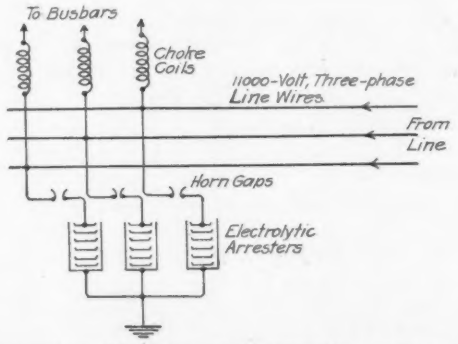


Fig. 5—Connection Diagram for Electrolytic Lightning Arrester Groups C and D.

Each wire of the two branches of the outgoing 15,000-volt line is terminated on a disk-type strain insulator, supported on a structural steel bent, as shown in Fig. 9. A tap from each line wire is carried up to each arrester

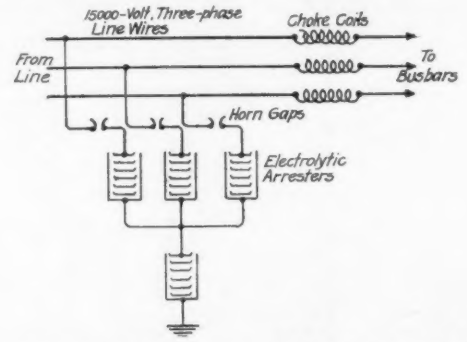


Fig. 6—Diagram of Connection of 15,000-Volt Electrolytic Lightning Arresters A and B.

terminal and another tap from each line wire is carried down to the choke coils which are inserted in each of the six wires just outside of the entrances.

One of the most interesting features of this installation

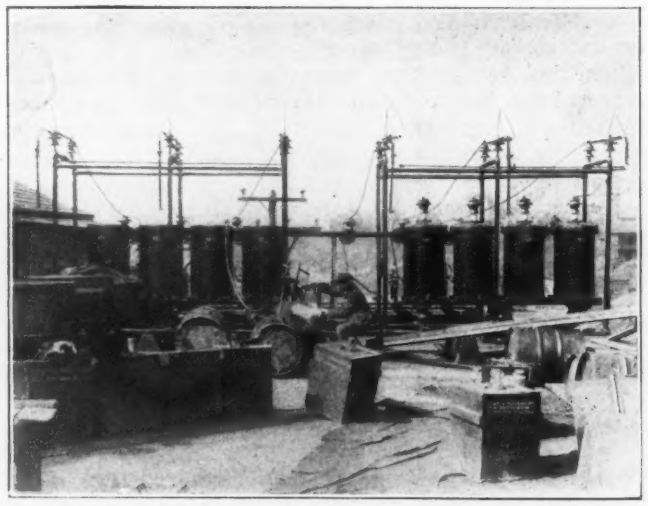


Fig. 7—Arrester Group in Course of Erection, Showing Rotary, Hand Oil Pump.

is the construction that was adopted for supporting the electrolytic arrester tanks, the choke coils and the line transmission insulators. Practically all of the supporting structure is of either concrete or structural steel. Concrete piers, which are bonded to the concrete roof of the station,

are used to support the structural steel members forming the frames.

The arrester supporting frames were assembled during the winter months. The steel sections were cut to length, drilled and bolted together on the roof. Although the supporting structure was erected during the winter of 1910, the arresters were not placed in service nor filled with electrolyte until the following spring. Fig. 7 is from a photograph taken while arresters *A* and *B* were being erected. The electrolyte for the arresters was received in carboys, and in filling the arrester trays a couple of quarts of electrolyte were poured from a carboy into a glass vessel and from this a quantity was dipped with a small aluminum measuring cup and poured into each tray. The tray structures of the arresters are divided into sections. Three are shown in Fig. 7. A man can readily handle a section full of electrolyte and place the section within the tank. After a tray section, filled with electrolyte, had been placed in its position in a tank the remaining volume was filled with a special oil.

The insulating oil was received in the steel cylinders shown in Fig. 7 and was pumped therefrom into the arrester tanks with a rotary, hand oil pump. This pump was found to be a very satisfactory appliance for its purpose. It is shown in Fig. 7 standing in an oil cylinder.

Each night at about 1 a. m. all of the arresters are charged—that is, their horn-gaps are closed for an instant to reform the films of aluminum hydroxide on the arrester trays, upon which the arrester depends for its successful operation. The station operator goes to the roof so that he can note the appearance of the arc that forms between the horn-gaps. From this he can judge of the condition of the arrester.

During normal service discharges are frequently shunted to ground by the electrolytic arresters. Most of the disturbances arising are due to slight surges caused by switching, but some severe lightning discharges have been handled with perfect satisfaction and without interruption to service. The arresters are inspected frequently and an elaborate inspection will be made yearly. The annual inspection will involve removing the tray structures from the tanks and a minute inspection of the trays, tanks and supporting structure. New electrolyte and oil will be supplied if it is found necessary.

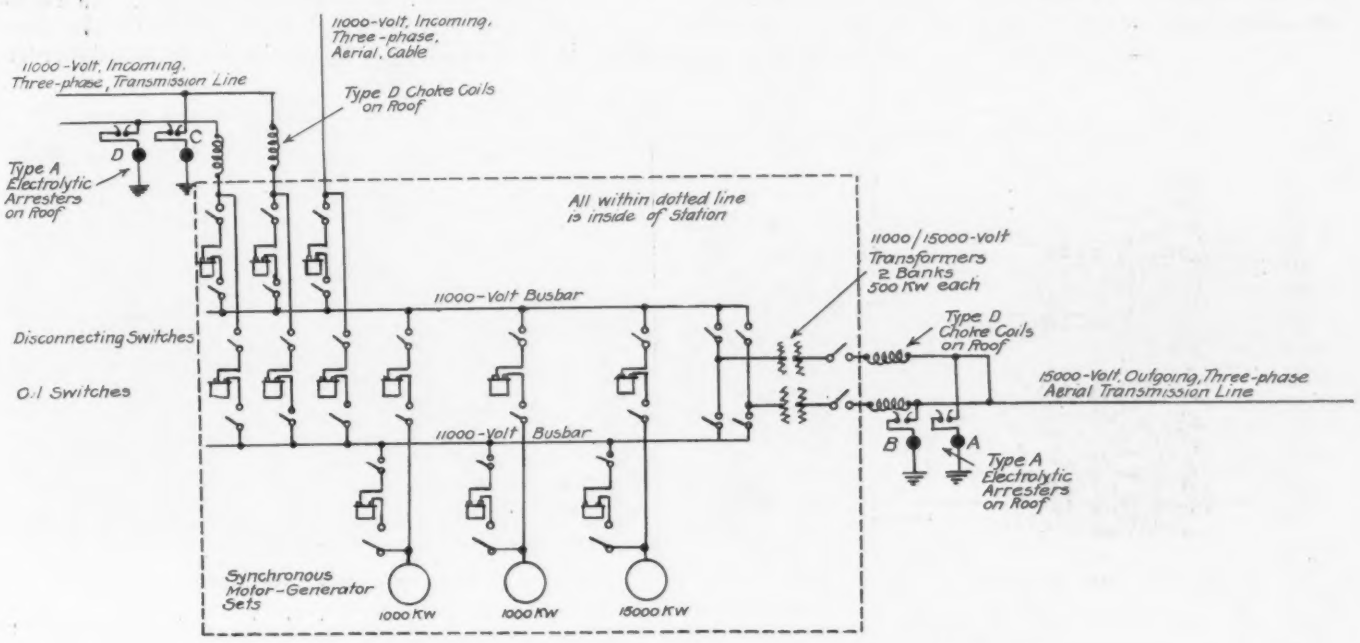


Fig. 8—Diagram of Alternating-Current Lines in Tunnel Substation.

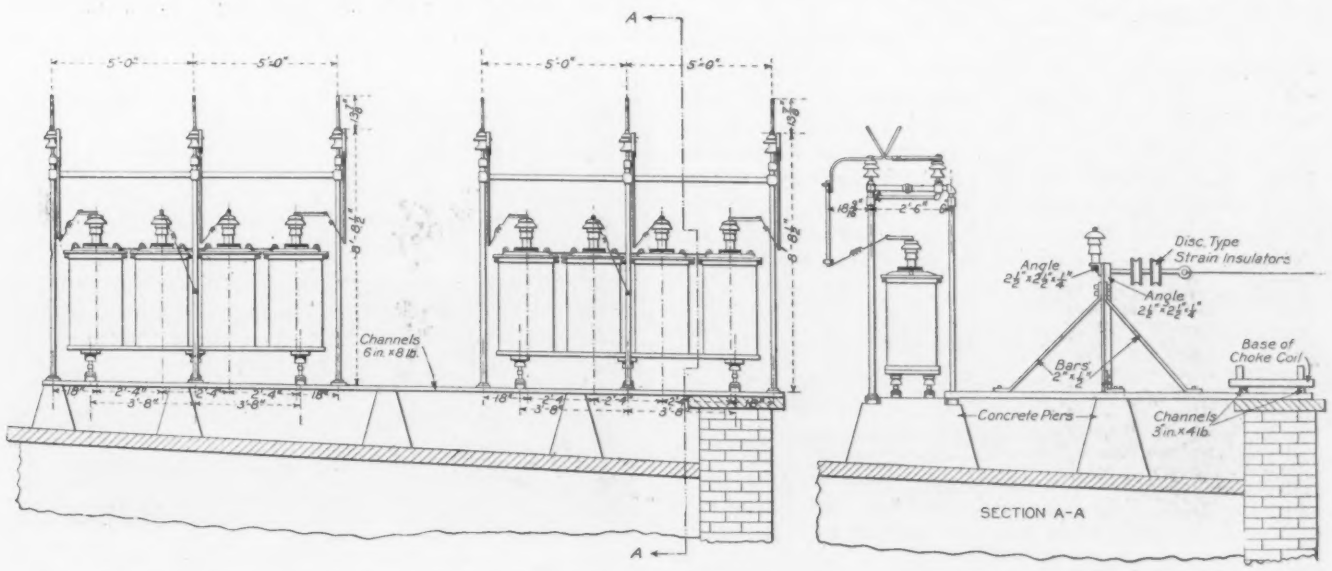


Fig. 9—Diagrammatic Drawing Showing Steel and Constructional Details of Frame for Arrester Groups A and B.

For the protection of the outgoing 600-volt trolley feeders twelve Westinghouse type MP arresters are used. They are installed, as shown in Fig. 10, on the side wall of the station, just over the points where the feeders enter the building. They can be easily inspected from the roof and, although they are weatherproof and do not really need protection from the elements, the eaves keep snow and ice

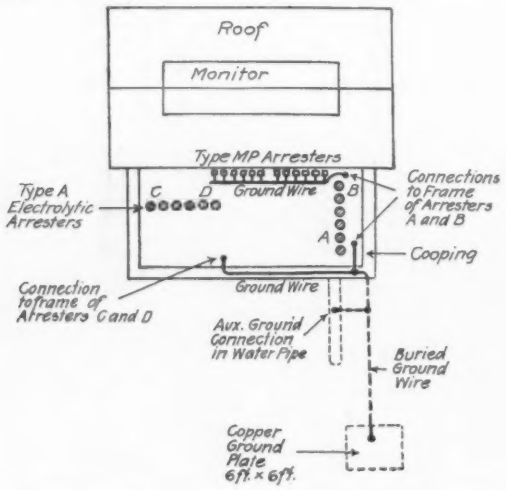


Fig. 10—Diagram Showing Details of Connections of 600-Volt Arrester.

from forming on them. The ground wire from the arresters is carried along the wall just above them. These arresters are of a very simple construction, but have protected the trolley feeders perfectly. No choke coils are inserted in the trolley feeders.

There are two ground connections for the lightning arresters and they are located as indicated in Fig. 10. One connection is a copper plate 1/32 in. thick and 6 ft. square, buried at a depth of about 5 ft. in the bed of a creek where the earth about it is always moist. The other and auxiliary connection is made by attaching a branch ground wire to a 2-in. galvanized-iron water pipe that supplies the station. The attachment was effected by serving the No. 0000 copper ground wire around the pipe, as shown in Fig. 11, for a distance of about 12 in. and soldering it thereto. Both the pipe and the wire were thoroughly "tinned" before the serving was made.

The main ground wire consists of two strands of No. 0000 copper trolley wire and the auxiliary ground wires each consist of one strand of the same size. The main ground wire is connected to the *C* and *D* arrester supporting frames, as shown in Fig. 3, by steel bolts which pass through lugs soldered on the ends of the wires. The ground wire is then carried along the coping, as shown in Fig. 10, makes connection with the supporting frame of arresters *A* and *B* (providing a ground for them), and

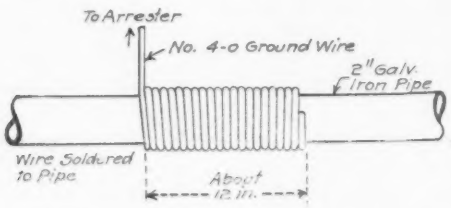


Fig. 11—Method Followed in Attaching Ground Wire to Water Pipe.

passes down the side of the station to the buried ground connections.

The entire Tunnel Station installation was engineered by the operating department of the Pittsburgh Railways Company. Mr. P. N. Jones is general superintendent, Mr. J. W. Welch is electrical engineer and Mr. H. A. Pharo is superintendent of overhead lines.

AN INDUSTRIAL INTERNATIONAL TRANSMISSION SYSTEM.

An industrial high-tension transmission line has just been built to connect the generating station at the Copper Queen Smelter at Douglas, Ariz., with a substation at Tigre Mine Inn at Sonora, Mexico. The line, which is 65 miles long, crosses the international border

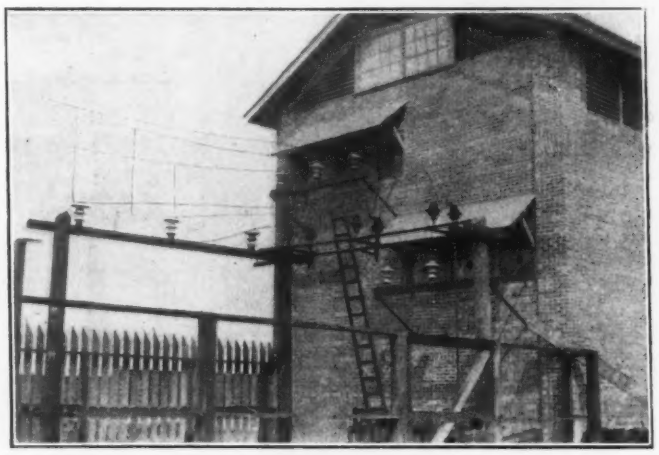


Fig. 1—Douglas Substation.

between the United States and Mexico and its completion and successful operation is particularly interesting in view of the fact that much of the work was done during the violent disturbances incident to the recent insurrection in Mexico. The construction work was in progress during the battles which took place opposite Douglas and along the Nacazari Railroad, which the line follows as far as Ysobel. The construction gangs were repeatedly driven back from their work by the insurrectos and considerable damage was done to the completed portions of the transmission circuits and the telephone line. Notwithstanding these obstacles energy has been transmitted from the smelter of the Copper Queen Consolidated Mining Company, at Douglas, to the Tigre mine since June.

The system consists of a single wood-pole line carrying three conductors of No. 4 copper arranged on 6-ft. centers in an equilateral triangle, one conductor on the top of the poles and one on each end of the cross-arm. The cir-

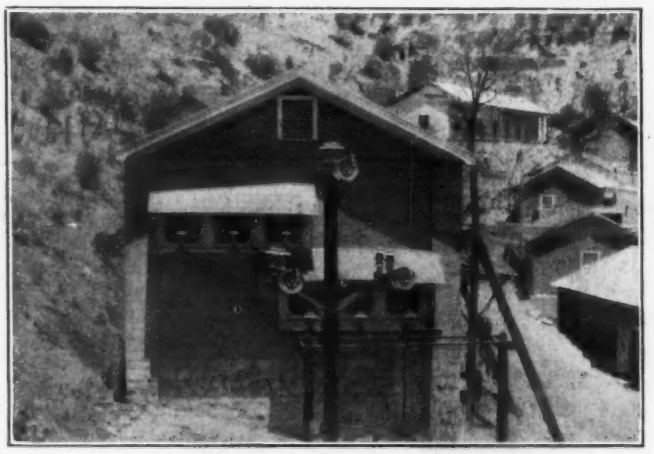


Fig. 2—Entrance Into Tigre Substation.

cuit is three-phase, 60-cycle, and the tension 44,000 volts. The poles, which are 35 ft. long and not less than 7 in. in diameter at the top, are spaced 200 ft. apart on the regular sections of the line with corresponding heavier construction and closer spacing to meet special conditions in certain localities. The poles were burnettized or zinc-treated throughout and have creosoted butts. The regular

poles are set with butts 5.5 ft. in the ground. The lower cross-arms employed are of standard construction, 4¾ in. x 5¾ in. x 6 ft. 10 in. long, bored vertically for ¾-in. pin bolts 5 in. from each end and horizontally with a ¾-in.

Fig. 3—Transmission Line.

hole in the center. The small top cross-arms, shown in Fig. 3, are 4¾ in. x 5¾ in. x 12 in. long, bored vertically for ¾-in. bolt in the center of the arm and horizontally with ⅝-in. hole for a U-bolt which clasps the pole top. Double cross-arms are used on all turns.

The insulators are of porcelain 13¼ in. high with cast-iron thimbles cemented in. Each insulator was subjected to a dry test of 150,000 volts, a rain test of 110,000 volts and a steam test of 100,000 volts. The leakage distance of the insulator is 37.5 in. and the arcing distance 9.5 in. The insulator pins are of the all-metal separable-thimble style of the Lee type. The insulators were made by the Locke Insulator Manufacturing Company, Victor, N. Y. The telephone line comprises standard Western Electric instruments with reducing transformers and drainage coils, the wires of the circuit being carried on the cross-arm 7 ft. below the transmission wires. The telephone wires are transposed between each four poles.

The plant of the Copper Queen smelter is modern in type, the generators being driven by two General Electric horizontal, low-pressure turbines rated at 750 kw each.

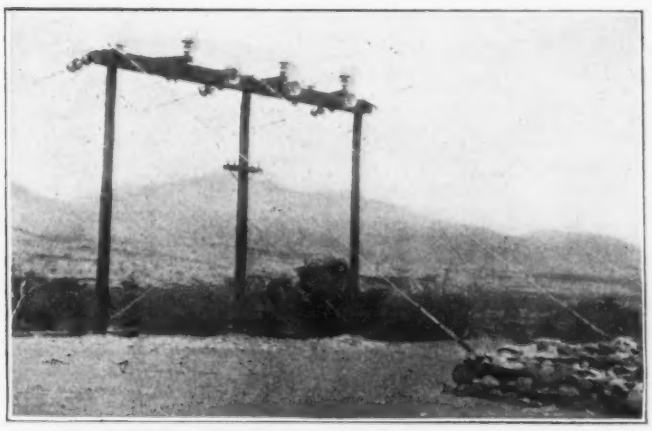


Fig. 4—1650-ft. Span at Barispe Crossing.

From the switchboard a three-phase circuit of 2300 volts leads through an underground system to a substation 700 ft. distant containing four 400-kva, oil-insulated, self-cooled transformers which step up the potential to 44,000 volts. The transformers, switchboard and lightning-arrester equipment are of General Electric manufacture. At Tigre Mine Inn the substation is equipped with four 400-kva transformers of similar characteristics, and the switchboard and lightning arrester equipment corresponds to that installed at Douglas. The line and stations were designed and constructed by Messrs. Sanderson & Porter, of New York and San Francisco, Mr. H. Hartwell being the resident engineer.

THE ELECTRIFICATION OF A GOLD REDUCTION MILL.

THE extension of electric power service into the gold-mining industry of Colorado is one of the most important developments of the State. A wide movement toward more scientific mine management is well under way in Colorado, and in the direction of improved economy of operation electric power applications are largely displacing less efficient methods of machinery driving. One of the most highly developed systems operating in the mining districts is that of the Central Colorado Power Company. The work of displacing older forms of motive power by this organization proceeds along the lines of a thorough engineering investigation and report upon all important propositions, comparing the cost of electrical operation with the expense of maintaining the existing service and pointing out the benefits to be gained by motor driving as contrasted with the handicaps of mechanical operation. In the following paragraphs are given the essential features of a typical report which led to the adoption of the electric drive in a gold reduction mill, the former installation being a combination steam and water-power outfit.

The test covered by the report was made with the object of determining what saving, if any, could be effected in the operation of the mill by using the electric company's service to carry the entire mill load for six months of each year and to carry the mill load in excess of the capacity of the existing waterwheel equipment for the rest of the year. The test showed that the electric drive would effect a saving of about $2,000 per annum, which was over 30 per cent of the existing cost of energy.

The mill equipment consisted of the following machinery:

A. Coarse Crushing and Sampling Plant.—1.9-in. x 15-in. Blake crusher; two Vezin samplers, 36 in. x 24 in.; two 10-in. x 6-in. belt and bucket elevators, 60 ft. long, 53 ft. 7 in. center to center; two Mitchell sample crushers; one sample grinder.

B. Fine Crushing Department.—Twenty 800-850-lb. gravity stamps, 7-in. drop, eighty-eight drops per minute.

C. Concentrating and Regrinding Department.—Seven concentrating tables; one vanner; three tailing pumps; one mill water pump; 1-5 in. diameter Colorado Iron Works grinding pan; one agitator, not operated during test.

D. Miscellaneous.—One 3-kw, 1150-r.p.m., 115-volt Fairbanks-Morse lighting dynamo; one 4-kw, 6-volt, 1300-r.p.m. dynamo, for energizing mercury traps and agitator; one 17-kw, 700-r.p.m., 125-volt dynamo, not operated.

The mill operates twenty-four hours daily, treating from 60 tons to 75 tons of auriferous sulphide custom ores. The stamp batteries, concentrating and regrinding machines are operated continuously; the coarse crushing and sampling plant is usually operated on the day shift only, but when necessary another shift is added.

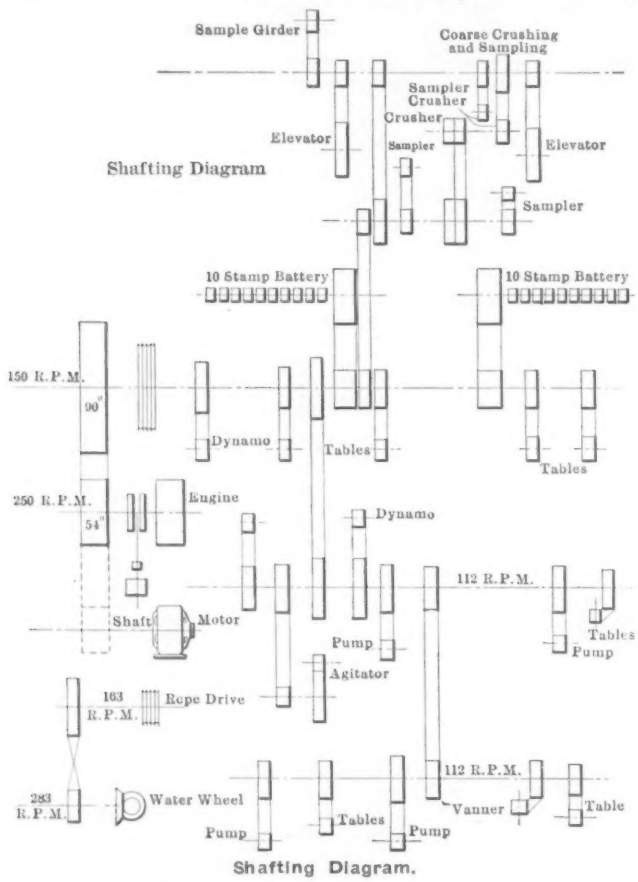
The coal used was lignite lump, from northern Colorado, costing $4.25 per ton in the bin. The boiler-feed water was decanted from the mill-supply water drawn from a nearby creek, the charge for water being $5 per month for all used.

The power-plant equipment consisted of one 12-in. x

14-in. Frost high-speed, automatic engine; one 100-hp, 66-in. x 20-ft. horizontal return tubular boiler; one boiler-feed pump and injector, and one closed feed-water heater.

In the summer months one of two No. 23 Samson turbines operating at 283 r.p.m. under a head of 16 ft. is rented from an adjoining concentration establishment, and from the test a minimum of 33 hp was found to be available for driving the gold mill. The concentrating works have prior water rights and at times, when operating, require water in such quantity that the gold-mill turbine must run under greatly reduced gate opening.

The test was run for one week, excluding Sunday, a record of apparatus in operation being kept continuously during the period. The horse-power demand for operating the mill under various conditions was ascertained by indicating the engine cylinder every half-hour, and more frequently under wide changes in load. Representative averages of horse-power demand were obtained for almost all conditions of operation. These averages, when combined with the recorded time of operation of the mill equipment, furnished a convenient method for obtaining the energy in indicated hp-hours for the entire week. Records of the weight of coal burned, checked and weighed back every



Shafting Diagram.

eight hours and of the feed water pumped into the boiler provided a convenient check on the hp-hours consumed. Boiler pressure was recorded every fifteen minutes and temperatures of the feed water before and after passing the heater were recorded at intervals of from sixty to thirty minutes. On two days of the test the water turbine was operated intermittently at full-gate and quarter-gate openings, supplementing the power of the engine. The records of the maximum power supplied by the turbine at full-gate opening were obtained by subtracting the indicated horse-power of the engine from the average horse-power required for operating the mill under the particular condition existing at the time the card was taken. Similar treatment was accorded the records when the turbine was operating under one-quarter gate opening. All steam outlets from the boiler other than the pipes leading to the engine, boiler-feed pump and injector were valved off, the valves being approximately tight and the pipes on the far side being cold. The exhaust from the boiler-feed pump and the overflow from the injector were piped to the feed-water suction so that practically all steam made was used by the engine.

The test showed that on the first four days of operation an average of 9010 lb. of coal was consumed per day. The coal per ihp-hour was 7.8 lb.; steam per ihp-hour, 47.5 lb.; average load, 48.2 hp; maximum load, 58.5 hp; evaporation, 6.11 lb. per pound of coal; feed-water temperatures entering heater, 50 deg. Fahr.; leaving heater, 176 deg. Fahr.; boiler pressure, 84.5 lb. average. For banking fires on Sunday 300 lb. of coal was required. On

SUMMARY OF RESULTS OF TEST.

April 26-May 2, inclusive, 1911. Altitude about 8,000 feet.

Average load on plant in indicated horse-power	47.5
Maximum demand observed during test, indicated horse-power	58.5
Load factor, excluding Sundays, per cent	81.0
Load factor, including Sundays, per cent	69.5
Energy consumption in six days' run, indicated hp-hours	6,834.0
Energy consumption per month on above rate, indicated hp-hours	29,613
Mechanical efficiency of engine, assumed, per cent	85.0
Equivalent input to electric motor of 50-hp rating, monthly kw-hours	20,880.0
Maximum horse-power demand on electric motor, horse-power	55.0
Average coal consumption per indicated hp-hour, pounds	7.8
Average steam consumption per indicated hp-hour, pounds	47.5

the two days in which the waterwheel was operated with the engine the average load varied from 41.1 hp to 50.7 hp. The total hp-hours required for the week's run were 6834, or a daily average of 1139, and the average load for the week was 47.5 hp. The total indicated hp-hours required for a run of one month of twenty-six days were 29,614. The total coal consumption required per month was 116.5 tons, including 1.5 tons required for banking fires and raising steam on Mondays.

The maximum power required by the coarse-crushing

ESTIMATED MONTHLY COST OF POWER.

Entire Mill Load Carried By:	
(A) *Steam Engine:*	
Coal, 116.5 tons at $4.25	$495
Labor, one extra fireman at $3	78
Oil, waste, supplies	10
Repairs, power plant	8
Total	$591
(B) *Electric Motor:*	
Fixed charge on 55 hp	$110
Energy charge, 20,880 kw-hours	261
Total	$371
(C) *Steam Engine and Waterwheel:*	
Coal, 60 tons at $4.25	$255
Labor, one extra fireman	78
Oil, waste and supplies	10
Repairs	10
Rent of waterwheel	75
Total	$428
(D) *Electric Motor and Waterwheel:*	
Fixed charge for motor amperes (25 hp)	$50
Energy charge, 8,000 kw-hours	100
Rent of waterwheel	75
One extra man	78
Repairs	5
Total	$308
Summary of Annual Saving:	
During six months of low water (A) and (B)	$1,320
During six months of high water (C) and (D)	720
Total annual saving	$2,040
Present cost of power, six months (A), six months (C)	6,115
Saving over present cost	33 1–3 per cent

and sampling department was 8.6 hp, the average being 6 ihp. As the rock was fed to the crusher intermittently the peak occurred when feeding hard rock and when the elevator buckets were loaded. Of the four centrifugal pumps there were three used for pumping tailings through lifts of 4 ft., 5 ft. and 12 ft., comparatively little power being needed. The fourth pump was used for water service, the head being 30 ft., diameter of discharge 3 in., and the power required 4.5 hp. The estimated power for the grinding pan when operating at a little below full rating

was about 5 hp. The detailed tests showed that the addition of each ore stamp required about 1.2 hp more from the engine.

The company pointed out that in addition to the foregoing saving the proposed change offered many advantages, particularly from the fact that concentration is an important factor in the reduction mill's operation. The assured steadiness of speed and consequent perfection of table regulation offered by the electric-driven plant were of great importance. The power company's service also afforded all the usual features of cleanliness and convenience and the elimination of power-plant and labor supervision from the manager's duties. The installation is also freed from dependence upon a coal supply which may be interrupted by strikes. Another point brought out was that if the supply of water in the flume for any reason was diminished to such an extent that there was water enough for only one turbine, the electrical installation is on the spot ready to furnish the full quota of power. It was installed without any material change in the transmission, as is apparent from the accompanying drawing of the mill installation. The saving in labor of one man per shift per month, mentioned under case (B), was made possible by the fact that the electrical installation requires little or no attention and during the day shift can be under the supervision of the foreman of repairs. The removal of the boiler plant also offered space for the installation of a cyanide equipment. In view of the above results and advantages the owner of the mill installed the electric drive and displaced steam.

REGENERATIVE CONTROL FROM A COMMERCIAL VIEWPOINT.

By J. Gustaf V. Lang.

IN earlier articles it was shown from the results of a number of tests that a saving in energy consumption of 25 per cent can be looked upon as a fair average to be gained by substituting double or single series-parallel regenerative control in place of the standard method. The question now arises whether the saving in energy, together with other advantages obtained by the substitution, really has a commercial value; in other words, whether the cost of the regenerative equipment is not so much greater than the interest and depreciation on the additional cost, together with possible increase in maintenance due to complications of the equipment, as to absorb more than the monetary value of the energy saving and of the other advantages.

As regards the motors, the additional cost of a double series-parallel regenerative equipment over that of a standard of the rating used at Norwich was found to be mainly due to the double armature winding and commutator and to some extent to the finely subdivided winding of the field coils. The controllers of the regenerative equipment naturally needed a number of extra fingers, since four armature circuits had to be controlled independently, and the shunt-field current and its control had to be taken care of. Moreover, the fact that the series field current of each motor had to be varied independently necessitated a couple of extra contacts. It is to be noted, however, that, the current being split up and divided over four armature circuits, each contact was of smaller size. The number of wires on the car was increased for the same reason, but their size was somewhat reduced. The field-changing switch (field-changer) and the shunt resistors were additions in their entirety. In consequence the cost of erection was increased.

The actual figures as determined by a concern in high standing in the electrical field from complete drawings of the equipment were based on the assumption of the regenerative equipments being manufactured in similar quantities with the standard. Changed into round figures of American money they were as follows:

ADDITIONAL COST OF DOUBLE SERIES-PARALLEL REGENERATIVE EQUIPMENT OVER STANDARD EQUIPMENT.

Two motors	$200.00
Two controllers	72.00
One field-changer	75.00
Shunt resistors	13.00
Car wiring	55.00
Erection	20.00
Total	$435.00
One-fourth for freight and installation charges	109.00
Royalty and development	75.00
Total	$619.00

If the regenerative equipment were of the single series-parallel type the motor complications would be reduced to that of the field coils. The controller complications would be reduced by half and the car wiring would also be considerably simplified. After due but conservative consideration of the reduction in complication the figures would then be modified approximately as follows:

ADDITIONAL COST OF SINGLE SERIES-PARALLEL REGENERATIVE EQUIPMENT OVER STANDARD EQUIPMENT.

Two motors	$50.00
Two controllers	61.00
Field-changer	75.00
Shunt resistors	13.00
Car wiring	45.00
Erection	20.00
Total	$264.00
One-fourth for freight and installation charges	66.00
Royalty and development	75.00
Total	$405.00

Figures were also obtained for the estimated cost of exchanging an existing standard equipment for a regenerative double series-parallel equipment. In this case the dismantling of the old equipment has to be considered. Some of the existing resistors may be retained. The old standard equipment is estimated to have a scrap value of $125.

COST OF REPLACING OLD STANDARD EQUIPMENT WITH DOUBLE SERIES-PARALLEL REGENERATIVE EQUIPMENT.

Two motors	$800.00
Two controllers	200.00
One field-changer	75.00
Car wiring	105.00
Shunt resistors	13.00
Labor of dismantling and erecting	75.00
	$1,268.00
One-fourth for freight and installation charges	317.00
Royalty and development	75.00
Total	$1,660.00

For a single series-parallel regenerative equipment the figures would be modified as follows for the same reason as given above for the modification of additional cost:

COST OF REPLACING OLD STANDARD EQUIPMENT WITH SINGLE SERIES-PARALLEL REGENERATIVE EQUIPMENT.

Two motors	$650.00
Two controllers	189.00
One field-changer	75.00
Car wiring	95.00
Shunt resistors	13.00
Dismantling and erection	75.00
	$1,097.00
One-fourth for freight and installation charges	274.00
Royalty and development	75.00
Total	$1,446.00

Subtracting the scrap value, there is for the double series-parallel regenerative equipment a net cost of exchange of $1,535 and for the single series-parallel regenerative equipment a net cost of $1,321.

It is impossible to say offhand how these figures would have to be modified by the adoption of a battery or motor-generator as the source for the excitation which gives to the motors the necessary shunt characteristic. Mr. Lundell advocates this in his letter to the *Electrical World*, published in the issue of Feb. 9, 1911. It is clear that motor complications can then be done away with entirely, as the subdivision of the field coils is no longer necessary. Mr. Lundell proposed the use of compensated motors with distributed field windings, and by means of this complication the motors are put on a plane even above the interpole motors and the size and cost are reduced on account of the improved ventilation and commutation. The change of excitation method also makes the field-changer superfluous, or if this device is retained it becomes simplified to a switch connecting the sources to the field coils when regeneration is desired. In place of the complications which have been dispensed with comes the battery or motor-generator. It is likely, therefore, that the figures given would not be changed enough to have any appreciable influence on the deduction which will be made with the above figures as the basis.

The next question to be investigated is that of the relative cost of repairs and maintenance of the standard equipment and the regenerative equipment of the double series-parallel and single series-parallel type. For this comparison the different cost items of the standard equipments at Norwich have been used as a basis.

Because of the regenerative action the mechanical brakes are required only for the final stop. In the previous article it was estimated that as far as kinetic energy was concerned the regenerative braking would take care of 99.5 per cent with a double series-parallel equipment and 93.7 per cent with a single series-parallel equipment. Since the potential energy is mainly absorbed at a speed above 3 ft. per second only a negligible part would fall on the mechanical brakes. As far as the wear of the brake-shoes depends on actual braking work it is evident that in case of a regenerative equipment even of the single series-parallel type it would be less than 10 per cent at any rate. There is no doubt, however, that a great deal of brake-shoe wear is due to poor adjustment. Since adjustments are less frequent for a regenerative equipment the wear on that account should be very much reduced. To figure very conservatively, the brake-shoe renewals of the regenerative equipment will be assumed to be one-fifth those of a standard equipment.

The same reasoning applies to the wheel rims, since naturally the wear on the rims will be reduced as well as the wear on the brake-shoes. Moreover, the regenerative braking is automatically non-skidding, and consequently the chances for flat places on the wheels are reduced very considerably—practically eliminated.

The gear wheels and pinions really belong to the motor equipment. It seems reasonable to expect that the additional duty on these parts due to the regenerative braking action will shorten their life in a proportion even somewhat greater than that which the regeneration bears to the input with the standard equipment. However, the increased renewal cost is amply offset by the saving in renewals to the wheel tires, and it is thought to be very conservative to assume that the latter does not more than balance the former, when in all probability it leaves a certain amount to the credit of the regenerative equipment.

The cost of motor repairs at Norwich was divided under the two general headings of mechanical and electrical repairs. In view of what has already been said as regards the gear wheels and pinions, the mechanical repairs should not be any greater than with the standard motors. Because of the existence of two commutators, double the number of brushes and the increased number of field-circuit and armature leads it was considered that the electrical repairs on the regenerative motors would be greater than on the standard. After making due allowance for the fact that owing to the double commutator each commutator deals with only half the current dealt with by the single commutator of the standard motor, it was believed that the electrical renewals of the regenerative motors would be 50 per cent greater than with standard motors. Most of the causes on which this increase is based disappear when the motors are those of a single series-parallel regenerative equipment. The increased number of leads and the extra regenerative duty are the only remaining causes, and in consequence the 50 per cent increase can be conservatively modified to 30 per cent for a single series-parallel equipment.

Experience has shown, it is claimed, that for a given size of motor equipment the cost of renewals to controllers and car wiring varies in direct proportion to the number of fingers and segments in the respective controllers. The total number of fingers and segments in the two regenerative controllers and field-changer is about 150 per cent greater than in the standard controllers at Norwich. But, after taking into consideration the small currents handled by these fingers in the regenerative controlling apparatus and the limited movement of the field-changer, it was believed that the item of controller and car-wiring renewals would be 75 per cent greater for the regenerative equipment than for the standard. This statement also refers to the double series-parallel regenerative equipment and should consequently be modified when a single series-parallel equipment is considered, as both the number of fingers and the wiring are simplified in this type of equipment. To what extent the 75 per cent increase in renewal cost should be cut down is rather difficult to determine; to be entirely on the safe side 75 per cent will be used for the comparison.

The average costs of renewals per car per year (31,000 car-miles) of the standard equipment at Norwich were as follows:

Brakes	$41.00
Motor, mechanical	14.00
Motor, electrical	26.00
Controller and wiring	15.00
Total	$96.00

Using these figures as a basis and applying to them the percentages above mentioned, a fair idea of the maintenance cost of a single series-parallel regenerative equipment is obtained.

Brakes, 0.20 x 41	$8.00
Motors, mechanical	14.00
Motors, electrical, 1.3 x 26	34.00
Controller and wiring, 1.75 x 15	27.00
Total	$83.00

Thus the total cost of maintenance and repairs compares at $83 to $96. In other words, the regenerative equipment has $13 per annum to its favor. Where brake renewals are heavier than at Norwich the saving in favor of the regenerative equipment would be still greater. It should be observed that the Norwich cars were single-truck cars and not particularly heavy. The average schedule speed was very low, being from 5.5 miles to 6 miles per hour. An increase in schedule speed, and thus in maximum speed, would naturally tend to increase the wear on the brake-shoes very materially on a standard car. It must also be remembered that the routes at Norwich were not very hilly—that is, the brakes were not called upon very frequently to check the descent on long and steep

grades, which naturally would have a decided influence on the brake renewals. All these considerations simply go to show that under conditions more favorable to regeneration a very substantial saving in cost of repairs and maintenance will have to be credited to the regenerative equipment in spite of the complications.

On the basis of the average saving in energy, of the additional cost of equipment, or cost of substitution, and of the comparative cost of maintenance and repairs it is feasible to obtain an adequate idea of the commercial value of regenerative control by applying the figures arrived at to average cases of energy consumptions and at different costs of energy.

ELECTRICAL DEVELOPMENT IN CHINA.

By L. R. Freeman.

ALTHOUGH the rich coastal provinces of China have no sites for hydroelectric plants of sufficient size to prove important factors in the development of the country, the natural conditions for such water-power development are practically ideal in the great interior provinces, where mighty rivers undergo great changes in level on their courses from the Tibetan plateaus to the sea. None of the principal cities, however, is within economical transmitting distance of a point where electrical energy could be generated in large amounts. Canton, Tientsin, Hankow, Nanking, Soochow and Shanghai are all located in the midst of flat river-valley or delta country, with no mountains of sufficient height near at hand to give birth to swift-flowing streams such as might be utilized for electrical development. Peking is within 20 miles of a fairly high range of mountains, but the precipitation in that part of China is insufficient to keep large streams running the year round. Foochow, with a half million or more people in its immediate vicinity, lies in a mountainous and well-watered country, and, though there are no data available on the subject, it is very probable that practicable sites of great value exist on the River Min or some of its swift tributaries within easy transmitting distance of this rich and populous center.

Anecdotes told of the Governor of Chekiang at a recent international dinner at Hangchow show the interest which the officials of even one of the so-called anti-foreign prov-

Fig. 1—Head of Gorges on the Yangtse-Kiang River, Containing Numerous Power Sites.

inces take in matters relating to material progress, and this attitude is indicative of what that of the officials of the great interior provinces, where the natural conditions for hydroelectric development are near the ideal, will be when the value of such development is brought home to them.

Nearly all of China's great rivers take their rise in the snows of the Tibetan plateaus at elevations of over 20,000 ft., and the largest part of their 4-mile drops to sea level is made in the course of their journeys through the rich interior provinces of that extensive empire. This is notably true of the mighty Yangtse-Kiang, one of the five largest rivers in the world, which descends nearly 12,000 ft. in

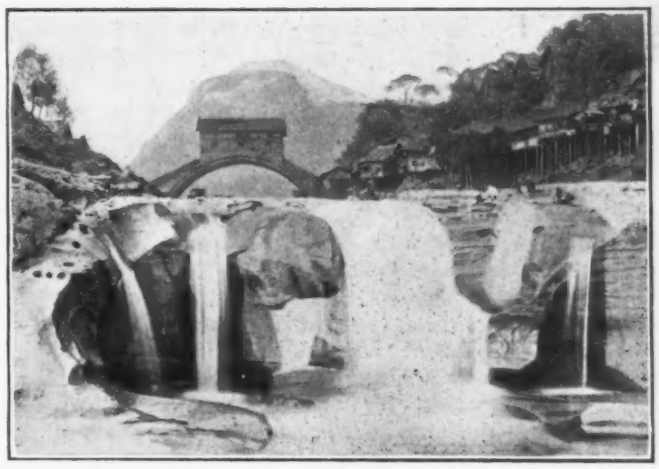


Fig. 2—Power Site with 80-ft. Head, Province of Szechuan, China.

traversing the province of Szechuan alone. It is in this province, rich, populous but almost wholly undeveloped, that the greatest field for hydroelectric endeavor will probably be found.

This remarkable province, in spite of the fact that it is cut off from the lower valleys of the Yangtse by a high range of mountains through which precarious communication with the rest of the empire is maintained only by caravans on land and junks on the river, has a population that is estimated at from 50,000,000 to 60,000,000, and is generally credited with being more prosperous, as well as richer in natural resources, than any other state of the empire. The cities, while not of great size as in the coastal provinces, are numerous, and there is hardly one of them but is within easy transmitting distance of a great water-

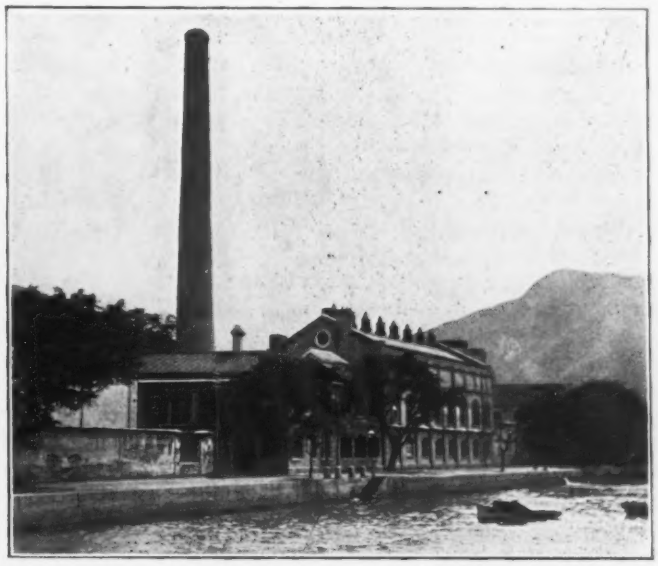


Fig. 3—A Modern Plant Which Is Now in Operation in the South of China.

fall, cascade or rapid where a power plant could be built.

The gorges of the Yangtse itself, in which the great river cuts through the mountain range dividing upper and lower China, descending 500 ft. in a series of rapids rivaling any in the world for swiftness and grandeur, have been the subject of conjectures from the standpoint of water-

power possibilities for many years. The mean flow of water at Ichang, near the lower end of the gorges, is reckoned at 750,000 cu. ft. a second, and, though the average fall through the several hundred miles of chasms is not great, there are places where the drop for a short distance is very considerable.

A prohibitive factor in the way of developing power in the Yangtse gorges seems to be the tremendous rise and fall of the water not only between season and season, but, at times, between day and day. The difference between the winter low-water level, when the river's sources are locked hard and fast in Tibetan snows and ice, and summer high-water level, when the snow and ice are being thawed and the flow further augmented by warm rains, is sometimes over 100 ft., and a 20-ft. rise in a night is not unprecedented. The difficulty of devising a system of diversion to meet such conditions is obvious.

At Hankow last summer the writer discussed this subject with a German electrical engineer who, while admitting it to be almost hopeless to try to turn the power of the Yangtse gorges to practical advantage in the ordinary way, was sanguine of the success of a plan involving the use of huge barges, with water-wheels at the ends and sides, which

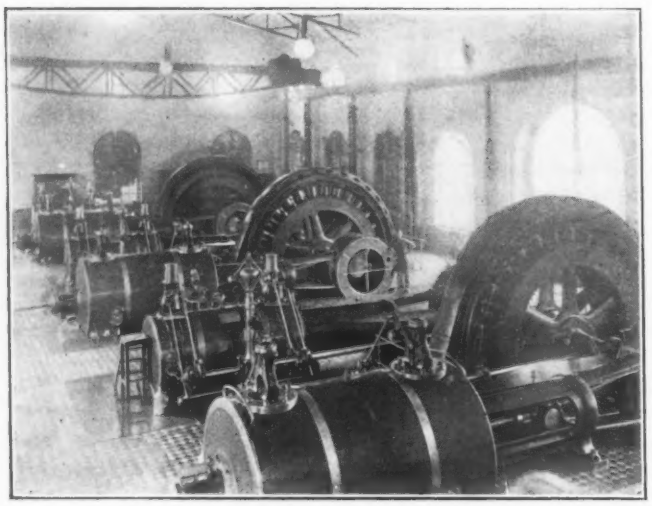


Fig. 4—Electrical Installation in Tongshan Colliery.

were to be anchored at favorable points in the swiftly flowing current. He was only in the "model" stage of his scheme at the time and since then nothing has been reported of his having experimented on a larger scale.

Yunnan, which, with the great province of Szechuan, forms the eastern portion of China, is to have the first hydroelectric plant to be erected in the Celestial Empire. The conditions there for power development are hardly as favorable as in Szechuan, nor is it by any means so rich and populous as its sister province, but the completion of the French railroad from Haiphong, on the coast of Tongking, to the capital, Yunnan-fu, furnished adequate transportation facilities for the requisite machinery and the enterprising city lost no time in taking advantage of the opportunity offered of securing a modern lighting plant. The success of this pioneer plant will assure the installation of similar ones at various points in the same province, while only the completion of the Hankow-Szechuan railroad or the inauguration of a safe and regular steamer service through the Yangtse gorges is necessary to set the ball of progress rolling in China's rich and prosperous northeast province.

The work on the hydroelectric plant at Yunnan-fu is now well under way, and through the courtesy of the Shanghai office of Carlowitz & Company, the German firm which has the contract for its construction, it is possible to furnish here the first details of this important project that have been given to the public.

Yunnan-fu is a city of about 70,000 inhabitants, and in point of distance is farthest from Peking of all of the provincial capitals of the empire. Formerly a journey by junk of from six to eight weeks up the Yangtse and an overland trip of a month across Szechuan and Yunnan were required to reach it. The recent completion of the 535-mile railway has brought the city within a day's journey of the coast of the French colony of Tongking. The following is a translation of a letter written by Messrs. Carlowitz regarding this project,

"The electrical plant now in course of construction at Yunnan-fu is a municipal undertaking and is erected for the purpose of lighting the numerous yamen, or public buildings, besides the schools, police stations and the main streets. It is the first project of its kind in China, but, we hope, only the forerunner of many more which will doubtless be built when the people of this province learn the facility and cheapness with which power may be developed from their rivers and waterfalls.

"At a distance of about 15 miles from Yunnan-fu the water of one of the outlets of the Yunnan Lake on the Tsin-yu-tan plateau forms a suitable head in a very short distance, from which a channel is being constructed for generating the necessary power. Where the outlet touches the Tsin-yu hill a feeding channel will run through the rocky slope of the hill to the power station. The feeding channel will be built from quarried stone and hydraulic-cement mortar. Most of the stone material will be obtained in the course of blasting for the channel and the power house.

"The power plant consists of two waterwheel turbines, each developing 300 hp at a speed of 375 r.p.m. These turbines, supplied by the German firm of J. M. Voith, Heidenheim-on-the-Brenz, are arranged for direct coupling to two 275-kva, 10,000-volt, three-phase alternators. There are also two exciter sets to be direct-coupled to the generators, with all the necessary measuring and controlling instruments.

"The high-tension line from the power station to Yunnan-fu will be fitted on timber masts and will end at the great west gate of the city. The transformer house will be erected here at the northwest corner of the wall, where the incoming energy will be transformed from 10,000 volts down to 3000 volts. The transformer house is provided with two switch boxes, from which the energy will be supplied to the main distributing ring of lines in the inner city. All distributing transformers are to be fitted on wooden poles. Near the Viceregal Yamen a large transformer will be erected, and the whole line of high tension will be protected by a safety network.

"Three-phase energy will be distributed throughout the 110-volt low-tension system, the low-tension side of the transformers being protected by three-pole fuses inclosed in water-tight iron boxes."

Such is China's first hydroelectric plant-to-be. It is a small affair as far as size goes, but great in importance as being the forerunner of many more that must follow it before many years have gone by.

For machinery for steam plants for electrical generation China may be characterized as one of the most rapidly developing markets in the world. The conditions under which most of the municipal undertakings are promoted, however, are such that American and British manufacturers, with their insistence on cash-down transactions, are at a disadvantage for orders. The British commercial attaché at Peking writes as follows on this phase of the matter:

"Almost all contracts require to be financed by the contractors, and British firms, finding British manufacturers unwilling to supply plants except for cash, have sometimes co-operated with German firms, the latter arranging the finance in return for being allowed to participate. Payment is generally spread over two or three years when proper security is given."

Contracts were let last year for new electric-lighting installations at Chungking, Chengtu, Changsha, Nanking and

Ningpo, and for more or less important extensions at Shanghai, Hankow, Peking, Swatow, Mukden and several other places. Negotiations are now proceeding for a large plant at Hangchow and at several Manchurian cities. Indeed, there may be said to be an electric-lighting project in almost every city in China, the only difficulty being to find funds to carry them into execution. Among larger projects which are being seriously considered are electric-car lines for Canton and Peking. At present Shanghai and Tientsin are the only cities in the empire enjoying the advantage of such transportation, but they are not likely to enjoy this distinction long.

Central Station
Management, Policies and Commercial Methods

A 15-TON BOTTLE SIGN.

A bottle sign surmounts the new Emerson Tower Building in Baltimore which weighs 15 tons, and it is made to revolve by a 3-hp motor, so delicately is it adjusted. The bottle cannot be seen at night, but the huge illuminated letters spelling "Bromo-Seltzer" may be seen in two counties and far down the bay. The lettering is on the bottle in such a manner as to make the word readable as the bottle revolves. There are 314 lamps used in lighting the letters, each letter being 10 ft. high and 5 ft. wide. The bottle is 289 ft. above the sidewalk, and it requires 35 seconds for it to make a single revolution.

NIGHT VIEWS IN OKLAHOMA CITY.

Few cities of the size of Oklahoma City have more progressive central-station companies than the Oklahoma Gas & Electric Company, which is controlled by H. M. Byllesby & Company. At night the streets and many of the buildings are brilliantly illuminated, giving the city a metropolitan aspect and making it one of the most attractive in the Southwest. A booklet entitled "Night in Oklahoma City," which gives night views of many of the streets and parks, shows convincingly that Oklahoma City is exceptionally well lighted. The pictures are well executed and are engraved in such a manner as to give a much more realistic view of general night lighting effects than is ordinarily the case with pictures of this character.

SAN DIEGO LIGHTING AND MOTOR RATES.

The San Diego (Cal.) Consolidated Gas & Electric Company on Sept. 1 adopted a new schedule, reducing its lighting rate from 10.8 cents to 9 cents net per kw-hour, or about 16 per cent, with corresponding reduction in motor rates varying from 11 per cent to 27 per cent. Prior to 1902 the lighting rate was 25 cents per kw-hour, at which time it was reduced to 20 cents. The present management, which assumed control April 1, 1905, has, with the present reduction, lowered the rates approximately 55 per cent within a period of six years. The new rates in detail are as follows:

For lighting, first 100 kw-hours, per month, 10 cents; between 100 kw-hours and 200 kw-hours, 9 cents; between 200 kw-hours and 300 kw-hours, 8 cents; between 300 kw-hours and 400 kw-hours, 7 cents; between 400 kw-hours and 500 kw-hours, 6 cents; in excess of 500 kw-hours, 5 cents. There is a minimum charge of $1 per month per meter installed.

For motors, first 100 kw-hours, per month, 8 cents; between 100 kw-hours and 200 kw-hours, 7 cents; between 200 kw-hours and 300 kw-hours, 6 cents; between 300 kw-hours and 400 kw-hours, 5 cents; between 400 kw-hours and 500 kw-hours, 4 cents; between 500 kw-hours and 1000 kw-hours, 3 cents; in excess of 1000 kw-hours, 2 cents. There is a minimum charge of $1 per month per horsepower connected.

Both schedules are subject to a cash discount of 10 per cent if paid within ten days from date of bill, thus reducing the basic lighting rate to 9 cents per kw-hour.

THE ELECTRIC VEHICLE IN BOSTON.

The campaign to further electric-vehicle business started last March by the Edison Electric Illuminating Company of Boston is bearing good fruit in frequent sales and abundant inquiries throughout all New England. This is true of both pleasure and commercial vehicles. As an example, the Chase Express Company, of Brookline, which has one 5-ton electric truck now in operation, is about to add another. Another instance is John F. Fleming, of Brookline, who is erecting a large garage to be used in connection with his present extensive establishment, and who will have in the new building facilities for charging electric cars, which are enjoying an increasing popularity in this residential suburb of Boston. Agents for electric vehicles report a growing interest among central-station people in the matter of charging cars, and the problem of how to do this most advantageously, economically and profitably is being studied and worked out by a large number of superintendents of plants.

LOUISVILLE STREET-LIGHTING CAMPAIGN.

An interesting method which was used by the Kentucky Electric Company, of Louisville, acting in conjunction with the Federal Sign System, has enabled it to make a beginning in street-lighting service, the municipal contract for which is held by the Louisville Lighting Company, the older central-station company of the Kentucky city.

The Kentucky company, of which R. E. Hughes is president, arranged to light two blocks in the congested district, Second to Fourth Street on Jefferson being the district chosen. The Federal company arranged for the erection of ornamental iron standards, surmounted by five opalescent globes. Four of these, each 10 in. in diameter, are pendent, containing each a 60-cp tungsten lamp, and the larger, 18 in. in diameter, contains a 100-cp tungsten.

The standards are placed at close intervals on both sides of the street for the two blocks referred to, and the cost of maintaining them is borne by the storekeepers affected. There was little difficulty, it was reported, in securing the co-operation of the merchants, and the Board of Public Works of Louisville also agreed to the erection of the standards without objection.

The newspapers gave a good deal of space to the lighting of the street, referring to it as "the great white way," and special editions, filled with copious advertising of the stores along the thoroughfare, as well as the lighting and sign

companies, were issued by several of them. It is stated that in all probability other sections of the city will be treated in this way.

A few years ago Louisville was not conspicuous as a brilliantly lighted city, but activity in developing electric signs, of which there are now many notable ones, as well as such work as that just described, has resulted in the business section being as well illuminated as any other city of 250,000 inhabitants in America.

MILWAUKEE CENTRAL-STATION STATISTICS.

At the recent Manufacturers' Exposition in Milwaukee the Milwaukee Electric Railway & Light Company displayed a large picture of the Commerce Street generating station, which is now undergoing extension and which will have an ultimate rating of 80,000 hp. The company also gave on placards some interesting information about the extent and growth of its business. The connected motor load consists of 21,822 hp, while the lighting load amounts to 521,740 16-cp lamp equivalents. For the year ended July 1, 1911, the increase in the number of power customers was 25 per cent, while the motor load on the buses increased no less than 68 per cent. During the year the company sold to its customers more than $40,000 worth of electric motors.

THE NEW YORK EDISON COMPANY NOW HAS NINETY-FIVE ELECTRICS.

Twenty-one new electric vehicles have recently been put into the service of the New York Edison Company, swelling the total number now in use to ninety-five. Six of the new electrics are for the use of the meter department. They have a capacity of 3000 lbs. apiece and are equipped inside with iron racks running along the sides for holding the meters. There is an alley way in the center, while the spaces for the meters are of different sizes in order to accommodate the various kinds of meters, each wagon carrying forty-two.

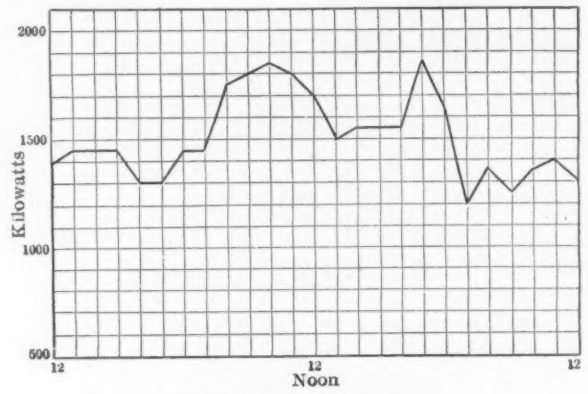
The idea was originated by the men of the meter department, and was suggested by the manner in which pies are carried in a bakery wagon. Each meter compartment is cushioned on the bottom and part way up the sides, as well as over the sill. A meter is placed in one of these compartments as soon as it is tested and taken directly to where it is going to be used. Too much handling and rehandling is apt to throw the delicate mechanism out of adjustment. These vehicles are Lansdens, Detroits and Walkers.

Ten 1000-lb. lamp delivery wagons are among the new cars, eight for Manhattan and two for the Borough of the Bronx. Five of these cars are the Baker and five are General Vehicle. Two others of the new wagons are the lightest the company possesses, having a capacity of 750 lb. each. One of these is used in the Bronx to take the foremen to the different jobs and for the delivery of light material. The other distributes advertising literature and flatirons. These were also made by the General Vehicle Company.

There is also a 4000-lb. wagon for the Third District distribution department, used to carry crews and material for all service jobs. This has a solid top with wire netting on the sides, giving light and air. The netting can be raised and lowered. This makes nineteen commercial vehicles added to the transportation department, while the other two are Baker runabouts used by heads of departments in going about on company business.

A CREDITABLE LOAD CHART.

The accompanying load chart of the Winona (Minn.) Railway & Light Company for July 20, 1911, is of unusual interest. It indicates a pretty close approach to the central-station ideal and is a credit to Mr. Frank H. Plaice, until recently general manager of that company. The maximum load on the busbars on that day was 1850 kw at 5 p. m. and the minimum was 1200 kw at 7 p. m. The average load for the twenty-four hours was 1537 kw, the load-factor reaching the astonishingly high figure of 83 per cent. The total output for the day was 36,900 kw-hours. This record is exceptional, even for Winona, but for the entire month of July (744 hours) the load-factor on this station was 70 per cent, while for the first seven months of 1911 (counting 212 days of twenty-four hours each) it was 52.5 per cent. The earnings for the month



A Creditable Load Chart.

of July were a trifle over $1 per capita for the entire population of the city.

Mr. Plaice is a great believer in motor load for central-station plants, and the results of his campaign justify his expectations. The load-factor for the year 1910 was 38 per cent, but, with the growth of motor load, it has mounted up steadily, as shown by the figures given. It may be added that the increase in total earnings, comparing July, 1909, and July, 1911, was 100 per cent. As the company is controlled by the La Crosse Water Power Company, it is able to make a low rate, undoubtedly, for electrical energy obtained from water-power development. Furthermore, the company operates a street railway and transmits energy to nearby communities, thus helping the load-factor. However, with all these favorable conditions taken into account the showing is an excellent one. The earnings of $1.01 per capita for the month of July, 1911, were divided as follows: Lighting and motor department, 83 cents; railway, 18 cents.

TESTING UNDERGROUND CABLES.

An interesting adaptation of apparatus is about to be introduced into the operation of the Edison Electric Illuminating Company of Boston. A problem was presented in the providing of facilities for the testing of underground cables, either after they had been first installed or after repairs to them had been made. The Edison Company has twenty-seven or twenty-eight generator stations and substations, about two-thirds of which have underground conduits. Permanent testing outfits, one for each station, would have involved a large outlay. Consequently it was decided to provide a special testing set installed upon electric vehicles.

The company has bought a special motor-generator set, with the necessary transformers, reactances, etc., constructed very light to reduce the weight to the minimum.

and so built as to be put on two vehicles, on which it will be carried to any station where testing is required, and there used for the test. The input to the motor-generator is taken right off the busbars, and the voltage built up to the requisite test pressure.

The weight of this outfit is about 10 or 11 tons. It being too heavy to go on one vehicle, it was decided to erect it on two 5-ton General Vehicle Company's electric trucks, with battery equipment sufficient to make the run from the central point to any of the company's stations at a reasonable rate of speed in any sort of weather. The motor-generator set is installed on one of the cars and the rest of the apparatus on the other.

The apparatus consists of the following: Eight hundred-kva, 2200/30,000-volt transformer, 850-kva, 2200-volt reactance and 100-kw, four-bearing motor-generator set, consisting of a 100-kw, 1200-2200-volt generator, a 100-hp, 1200-2300/4000-volt motor, a 125-volt exciter mounted on wooden base and connected by a flexible coupling, together with a starting compensator and two field rheostats. Other apparatus consists of two motor-driven blower sets, two 2200-220-volt transformers, twelve lifting jacks, canvas covers, ammeter, voltmeter, portable current and potential transformers, one 50-watt potential transformer and a Hartman & Braun frequency meter.

The truck will have a clear loading space 6 ft. wide, 15 ft. long and 6 ft. high. Its weight without battery and load will be 7500 lb., and the weight of the battery will be about 2400 lb., it being of the sixty-cell Edison type. The wheel base will be 139 in., wheel gage 69 in., front tire 36 in. x 7 in., rear 36 in. x 5½ in. twin. Its rated speed, loaded, on a hard, level, asphalt road, will be 7 miles per hour, and the estimated mileage, one charge, on hard, level road, 30 miles.

The outfit is intended to have sufficient capacity to test 5 miles of underground cable consisting of 34-0 conductors, lead-sheath cable, built for 15,000 volts working pressure.

ELECTRIC POWER DEVELOPMENT AT DENVER.

An interesting phase of the electric power situation in the West is the remarkable diversity of business handled by progressive central stations. In comparatively few communities has general manufacturing attained a development comparable with the cities of the East, and outside the fields of mining and transportation motor applications have of necessity been made throughout multiplied rather than highly centralized industries. This is notably the case on the system of the Denver Gas & Electric Light Company, whose service in the capital city of Colorado is popularized to the extent of a present connected load of over 20,000 hp in motors, or about 1 hp for every eleven inhabitants of the district covered by the company's lines. Manufacturing on a large scale is chiefly related to the metallurgical industries of Denver, but on a smaller scale power is required in a great variety of mercantile and productive establishments.

Within the past ten years the connected motor load of the company has increased from a total of 1173 hp to over eighteen times that amount. The population of the city has increased about 60 per cent during the decade. In February, 1901, the company had no alternating-current motor service; in January, 1905, the direct-current motor service had increased to a connected load of 5447 hp, and the alternating-current connected motor load was only 54 hp in three-phase motors, while on Jan. 1, 1911, the connected motor load was as follows:

Direct-current motors	12,599 hp
Three-phase motors	6,890 hp
Direct-current fan motors	298 hp
Alternating-current fan motors	550 hp
Total	20,337 hp

The local street railway system generates its own energy, and the above motor load is almost entirely the result of a vigorous policy of making the most of the business of the comparatively small consumers. A recent survey of the total demand of the city outside the electric-traction field disclosed that the company is now supplying about two-thirds of all the industrial power that is utilized in the city.

RATES.

An important factor in this development has been the schedule of rates applied to motor installations. A rate of 4 cents per kw-hour is charged, with a minimum of $1 per month gross per horse-power for motors in excess of 3 hp, smaller motors being billed at a minimum of $3 per month. All bills are subject to a 10 per cent discount for prompt payment. An alternative rate is a fixed charge of $9 per year per consumer, plus $24 fixed charges per year per horse-power connected, plus 3 cents per kw-hour for all energy used. One-twelfth of the foregoing fixed charge is payable with the monthly bill for energy consumed. A 10 per cent discount also applies to the second rate, which is made on the basis of a year's contract.

A minimum charge of $5 net per month is made for 30-amp rectifiers on lighting circuits operated under an off-peak schedule, a charge of $6.75 being made for rectifiers operated each month without regard to the peak load of the company. Motor service in the commercial district of the city is supplied at 220 volts direct current for motors of 2 hp and under. Above 2 hp service is supplied at 440 volts direct current, and in sections of the city removed from the immediate business center energy is supplied at 220 volts, three-phase. The frequency of the system is 60 cycles and energy is generated in three steam plants located in Denver, one of which is kept in reserve for emergency service only. The company purchases a large amount of energy from the Central Colorado Power Company's hydroelectric system, which distributes energy from generating stations located at Shoshone, which is 150 miles west of Denver, and at Boulder, which is 30 miles northwest.

A flat rate of $3 per month is made for use of 8-in to 16-in. desk or ceiling fans, with 10 per cent discount. The consumer installs the necessary wiring at his own expense, and in other applications the company prefers to leave the wiring and installation of equipment to local contractors. Fans are also rented at a rate of $1 per month plus $3 for energy, with the usual discount. The amount paid in rental applies on the purchase price of the fan if the consumer desires to buy it at the end of the season. The company sells fans at prices varying from $10 for the 8-in. size to $18.50 for a 16-in. outfit, an additional charge of $4.50 being made for an oscillating equipment. All single-phase motors and rectifiers operating on a lighting circuit are governed by an off-peak schedule which prohibits their use on a graduated scale of hours varying from 5 p. m. and 7:30 p. m. to 10 p. m., according to the season. The company requires auto starters to be installed on all single-phase motors of 5-hp rating and over and on all three-phase motors of 7.5-hp rating and above. All motor wiring is required to be inspected by the city electrician and the company before energy can be supplied to the installation. Since Jan. 1 last a cast-iron meter board costing about 25 cents must be installed with each motor group whose energy consumption is measured by watt-hour meters, from whose readings the bills are prepared. Only one set of outlets is allowed per building, whether the service be for lighting or power. In general, the direct-current service covers the district between Wynkoop and Twenty-first Streets, Broadway, West Colfax Avenue and the company's West power station.

REPRESENTATIVE POWER APPLICATIONS.

Special efforts are made to cultivate long-hour, off-peak and day loads, although the company's power service ex-

tends over all hours of the day and night. Electric energy is used exclusively in all the paint factories of the city, in all but one foundry, in all the brick plants which are situated on the company's distribution system, in all but one of the principal hotels, in all the stone-crushing plants in town, in refrigeration service, in the operation of contracting plants and erection of buildings, in the principal railroad shops, United States Mint, lumber, box and iron works. Among the recent important contracts obtained by the company are the Union Pacific Railroad shops, 1000 hp; Mint, 708.5 hp; Griffin Wheel Company, 500 hp, and Call Switch & Frog Company, 115 hp. A recent development is the planning of loft buildings for groups of small manufacturers located under a single roof. A six-story structure of this character will shortly be completed and each of four floors will be provided with special circuits capable of delivering about 100 hp to the tenants. One high-speed passenger and one freight elevator will also be installed. It is probable that the company will deal directly with tenants in structures of this kind, metering each consumer's load separately.

ELECTRICITY IN BUILDING CONSTRUCTION.

A valuable class of day motor-load business has of late come into much prominence in Denver in connection with the erection of new buildings. Contractors are rapidly doing away with inefficient and costly steam engines for building operations and handling their work by central-station service. At the new Episcopal Cathedral under construction in the Capitol Hill district the contractor's work was greatly facilitated by the service of a motor-driven stone-cutting plant, including a traveling crane operated by one 7.5-hp motor and one 3-hp motor, and a marble saw driven by a 15-hp, 220-volt, three-phase induction motor. The absence of a steam-driven plant was much appreciated by the residents of the district surrounding the structure and further advantages accrued to the contractor through the facility with which marble was cut and handled upon the ground, much time being saved through the use of electrically driven apparatus. A temporary transformer installation supplied energy to the motors from the regular distribution circuits of the company. A prominent contractor owns two concrete mixers operated by 15-hp and 10-hp motors of the single-phase, 220-volt type, a bucket conveyor for concrete, driven by a 7.5-hp direct-current motor, a circular rip saw driven by a 6-hp direct-current motor and a 3-hp hoist of the Chattanooga type. A prominent electric supply company has five brick hoists, each driven by a 7.5-hp single-phase motor, and these are in constant use at a rental of $1 per day apiece.

Electric energy is being used in the erection of the new post-office building, there being in operation a 20-hp sand screen and a 20-hp marble hoist, the motors being of the 550-volt direct-current type. In the erection of the new First National Bank Building a 30-hp concrete mixer and a 7.5-hp brick hoist were used. In the work on the new Foster Building a 25-hp air compressor, a 5-hp brick hoist and a 15-hp concrete mixer were operated. Three concrete mixers, each driven by a 10-hp, 220-volt, three-phase induction motor, were used on the new Tramway Building, with a circular rip saw and planer driven by a 5-hp motor, and the work on the new Daniels & Fisher Building and tower was facilitated by the use of a 25-hp air compressor, a 15-hp concrete mixer, a 5-hp rip saw and a 5-hp brick hoist. All the steel members of the framing of the new Chamber of Commerce Building were elevated by a 7.5-hp electric hoist, a 15-hp concrete mixer and a 3-hp brick hoist also being used on this work. As a rule the contractors leave the making of connections to the company. In the finishing trade seven hardwood floor planers of the motor-driven type are in operation. Each is driven by a 3-hp, 220-volt, single-phase motor and a watt-hour meter is placed on each machine. A meter reader is sent by the company each month to the place where any given machine is at work. The labor cost of floor finishing is cut about 60 per cent by these devices, which are portable, and which perform their work far more rapidly than is possible by hand and without the unpleasant noise of the hand planer.

MISCELLANEOUS POWER SERVICE.

In the plant of the Western Box & Lumber Company 165 hp in motors are in service operating saws, planers and branding machines. The plant of the Sundquist Lumber Company handles a large amount of interior finishing product for residential construction. Planers, molding machines and a cut-off saw are operated by an installation of 30.5 hp in motors. In a representative lumber mill the sawdust is drawn by motor-driven fans into a storage space from which it is shipped in carload lots to powder mills. At the plant of the Longmont Milling & Elevator Company a steam-engine installation aggregating 375 hp was displaced by motors of much reduced rating and the operation of steam boilers was cut down 33⅓ per cent. The satisfaction which the company gained from the motor service led to the displacement of gasoline by electrical equipment in other localities covered by its operations.

Electric power is used in many laundries in Denver with excellent results. In one case a 10-hp installation produces a net revenue of $33.85 per month; in another instance a 12.5-hp motor equipment yields the company $30.95 per month, and in a third case an 18-hp installation yields $44.60 per month. In one laundry one of the largest mangles in the city is operated by a 3-hp direct-connected motor at a cost of about $6.50 per month. The number of sheets and flat pieces turned out is far in excess of the production under the former conditions of belt driving.

At the principal brickyards served the larger energy demand occurs mainly during the summer season. In a representative case a 40-hp motor drives a machine capable of producing 20,000 bricks per day of eight hours. In a yard producing 20,000 bricks per day, with two 50-hp motors on the circuit, the revenue to the company from the sale of energy was $150 per month.

Ice machines driven by electricity are in service at various points in Denver, including groceries, clubs, markets, restaurants, packing houses and florists' establishments. A 5-hp motor-driven equipment in grocery service will easily bring from $5 to $8 per month to the company. At the Denver Athletic Club an energy consumption of 4000 kw-hours was registered in February, and the equipment produced all the ice which was used by the club and handled all the refrigeration necessary for the preservation of meats and fruits. Elimination of dirt and maintenance of even temperatures have followed the introduction of this apparatus. A prominent florist, whose bills for energy for operating a refrigerating machine are about $18 per month with a 7.5-hp equipment, states that the cost is only about one-third that which he had to meet in purchasing ice, considering the amount of dirt encountered in ice. The company's experience shows that from 50 kw-hours to 60 kw-hours are required to produce 1 ton of ice at Denver by central-station service, the cost ranging from $1.50 to $1.80.

Among the other representative power installations in Denver are motors operating machinery for organ blowing in churches, elevators, coffee grinders, chopping machines, pumps, vacuum cleaners, shoe-repairing shops, hat cleaners, exhaust fans, automobile-tire pumps and numerous other appliances whose individual loads are small, but which play an important part in the aggregate. A recent development of importance is the installation of motor-driven pumps of from 3 hp to 5 hp each in connection with irrigation service in market-gardening sections of the suburban territory adjacent to the city proper. About a dozen of these pumps have now been placed in service and in one case the value of the land has been raised from $100 to $500 per acre as a result of electric irrigation. Not only

by this means can existing water supplies be applied more efficiently, but large areas of land useful only for grazing can be reclaimed for agricultural purposes and the load from the central-station point of view is excellent on account of its attaining its maximum during the summer and calling for a sustained consumption of energy during the warm season. At the State Rifle Range a 2-hp motor-driven pump has been installed to save the haulage of drinking water 3 miles in connection with target shoots. This business is entirely a day load and the pumping equipment is provided with automatic control located at the well. Motors are being installed to operate pumps in apartment houses to reinforce the water pressure in the supply piping of the city company. Another installation recently made is in St. Anthony's Hospital, Denver, a 30.5-hp motor equipment taking the place of isolated plant service. This service was formerly handled until 9 p. m. by the hospital plant, after which the load was carried by the company and the superiority and economy of the central-station service led the hospital authorities to discontinue the isolated plant. In the drug-store trade a 2-hp motor-driven pill-making machine is making a place for itself. At Crown Hill Cemetery a 10-hp motor has been installed on a pump used in irrigating lawns, and a 15-hp pump has been placed in similar service at the Colorado Golf Club. At the Denver Auditorium, seating 12,000 persons, two 7.5-hp motors are in service for the purpose of swinging the sides of the building interior in and out to form a theater or large hall as the conditions require. Five motor-driven exhaust fans are also in service in the Shubert Theater. The motor-load business of the company is handled by the commercial department, of which Mr. Ross B. Mateer is power engineer and Mr. Clare N. Stannard, manager.

Wiring and Illumination

COMPETITIVE ILLUMINANTS.

At the recent annual convention of the "Verband Deutscher Elektrotechniker" in Munich a very interesting paper was read by Mr. George Dettmar, secretary of the Verband, on "Electricity in the Household," abstracts of which have appeared in several issues of the Digest. Supplementing the latter notices, we print herewith a table showing the ratio of candle-power per unit of illumination in different rooms of an apartment lighted by gas which the author occupied previously and corresponding figures for his present residence, which is lighted by electricity.

This table shows strikingly the important fact that the efficiency of electric light as regards the conversion of candle-powers into illumination is very much higher than with gaslight, owing to the fact that the disposition of electric lamps can be made much more favorable than with gas. The article says: "The simple comparison according to candle-power, cubic feet of gas and kw-hours is absolutely wrong. It must be emphasized that a reasonable comparison can be made only on the basis of illumination, and it is always to be considered that the same illumination can be obtained with a considerably smaller intensity in case of electric light."

COMPARATIVE RATIO OF CANDLE-POWER PER UNIT OF ILLUMINATION IN ROOMS LIGHTED BY GAS AND ELECTRICITY RESPECTIVELY.

Room.	APARTMENT LIGHTED BY GAS.				RESIDENCE LIGHTED BY ELECTRICITY.			
	Area of Room, Square Feet.	Intensity in International Candle-Power.	Ft.-Candles Obtained.	Candle-power per Ft.-Candle.	Area of Room Square Feet.	Intensity in International Candle-Power.	Ft.-Candles Obtained.	Candle-power per Ft.-Candle.
Dining-room	314	288	1.01	285	348	299	3.99	75
Library	....	....	....	....	....	....	....	....
General illumination	296	396	1.92	206	256	90	1.4	129[2]
Desk illumination	..[1]	144	1.24	116	..[1]	22.5	2.84	7.8
Nursery	178	72	.86	84	178	45	1.36	33

[1]The distance of the light from the centre of the desk was with gas 6 ft. 11 in.; with electricity, 1 ft. 8 in.
[2]This is the figure obtained by computation from the corresponding German data. The figure, however, by some mistake seems to be double the size it ought to be, as can be seen from division of the figures in the two preceding columns, $90 \div 1.4 = 64.5$.

ORNAMENTAL STREET LIGHTING.

In a paper read by Mr. C. E. Stephens before the Pennsylvania Electric Association at its fourth annual convention Sept. 6, 7 and 8, 1911, the features of ornamental street lighting from the viewpoint of the illuminating engineer and the central station were well presented. The author claimed that good street lighting is the most convincing evidence always available by which citizens judge the success of the lighting company. The appearance of the streets gives the visitor a favorable or unfavorable impression of the city's thrift, depending very largely upon whether or not the illumination is adequate. In many cities one street or section thereof, or perhaps one side of a particular street, is congested with traffic, while other sections in the immediate locality are practically deserted. In some cases this condition can be attributed to the character of the business houses, but in a large proportion of the cases there is no doubt that the illumination of the several sections is responsible for the condition.

The fundamental problem to consider in the illumination of any street is the intensity of the illumination required and its production at a minimum cost. The cost includes the expenditure of energy, cost of maintenance and interest and depreciation for the lamps, plant and all auxiliary equipment. If the problem could be solved on an energy basis alone it would be logical to use a maximum number of light units with a corresponding reduction in their light flux and energy consumption. It is to be noted, however, that increasing the number of units also increases the installation and maintenance cost of the system. There is a point beyond which the cost for any increase in the number of units will exceed the saving in energy consumption. A point cannot be fixed which will apply generally on account of the innumerable variables (such as the intensity requirements in different sections of the city, obstacles which prevent a proper location and distribution of lamps, energy costs, etc.) which are involved.

The factors to be considered in arranging for good street illumination are uniform intensity, diffusion, intrinsic brilliancy of the light source and shadows. Assuming the minimum intensity of illumination as unity, the ratio between maximum and minimum illumination for business on other sections of the street where a high intensity is maintained should not exceed ten to one. For residence sections, parks and outlying districts the ratio should not be greater than five to one. This ratio of maximum to minimum illumination is smaller in the latter case because of the fact that where intensities of illumination are quite low the effect of the comparatively light and dark spots produces objectionable glare. Furthermore, it is in these sections of our streets that are found the fast-moving cars, automobiles and carriages.

In any illumination scheme it is objectionable to use a source from which the light flux issues from a point. This is particularly true in street lighting where relatively large units are employed, since it is impracticable to support a lamp at such a height that it will not come within the field of vision at a time when the eye is quite near the lamp. It is not feasible to change the nature of the light source, but by an intelligent use of the available glassware for modern street-lighting units it is possible to diffuse the light quite satisfactorily.

The author outlined the general characteristics of a suitable lighting unit as follows: The maximum intensity of the light unit should be from 15 deg. to 20 deg. below the horizontal and decrease rapidly above and below this angle; the total light flux from a single unit should be as small as conditions will permit—that is, for a given intensity of illumination use a maximum number of small units spaced at frequent intervals; the light should be diffused—that is, emitted from a large area; the lamp should be supported at the maximum height above the illuminated surface, especially so if it is of high candle-power and the light is not diffused.

In comparing the festoon arc and post systems of decorative street lighting the author said that the festoon system is rarely installed at present, having been superseded by the other two systems.

The flaming-arc lamp system operates at high efficiency and low maintenance cost. The maximum candle-power of this type of lamp is near the horizontal, and it is, therefore, possible to place the posts at great distances apart and at the same time secure a uniform intensity of illumination. This makes it possible to use a minimum number of poles—and possibly to make use of existing trolley or arc lamp-posts. The lamps can be supported at great heights above the street, above the critical angle of the eyes. The principal defect noted in a large number of arc-lamp systems is the tendency to support the lamps too close to the ground. This is particularly objectionable on account of the fact that the glare effect produced by the bright light in the eye causes a contraction of the pupil, which limits the amount of light entering the eyes and no advantage is gained by a high intensity of illumination.

The ornamental post system is perhaps the most popular of the three systems classed as ornamental. There are many post designs on the market arranged for from one to five lamps. They are installed on or near the curb on both sides of the street and comparatively close together. The lamps are supported in a pendent or inverted position and are usually supplied with energy from an underground system. The lamps and globes are easy of access for renewals and cleaning. The maintenance cost is reasonably low, particularly when the series type of lamp is used. The illumination of the street, when the units are properly spaced, is quite uniform and the required intensity is readily secured by a proper selection of lamp sizes. The first cost of installation varies with local conditions and the type of post adopted and the available source of energy supply. The principal objection to this system is the large number of posts required. This is a particularly objectionable feature in districts where there exist also a large number of trolley, telephone and other service poles. Some criticism has also been heard from installations in which the posts are quite near the curb, in that large moving vans, ice wagons and other vehicles strike the fixtures and shatter the lamps and glassware.

In summing up the general situation the author remarked that no one system can be adopted as the best for all installations. Local conditions very largely determine the best system to be installed. It behooves the central-station man to keep thoroughly posted on the advantages and value of the various systems available; to explain these items to interested officials and citizens, and to insist continually on superior street illumination, previous to the time when the unsatisfactory street illumination has prompted action on the part of the city authorities or civic organizations. The co-operative spirit of the central-station man and the manufacturer of illuminants should inaugurate a system of education for the public, to teach it that the glaring appearance of a street lamp should not be used as a measure of its excellence, and finally to strive to raise the standard of street illumination in the cities to a point where superior results will compensate for the increased cost.

Letters to the Editor.

Calculation of Flywheels.

To the Editor of Electrical World:

Sir:—In the article on page 559 of your issue of Sept. 2, on a calculation for flywheels of piston-driven prime movers, Mr. George T. Hanchett gives a theory which, although apparently of alluring simplicity, appears to be fundamentally incorrect for the following reasons:

With particular reference to steam engines, the indicator card is a direct measure only for the work done by the steam on that side of the piston to which the card relates. The work done by the steam for any part of the piston stroke is not identical with the energy delivered to the crank for the same part of the stroke.

The mean effective pressure has no other meaning than the constant steam pressure, which, if acting in the cylinder instead of the actual and variable pressure, would do the same work. It is in no way identical with the constant load at the crank shaft. In explanation, it may be added that the pressure exercised on the wrist pin is a direct measure of the difference of steam pressures existing simultaneously on both sides of the piston (or pistons). If the indicator card is used to ascertain this pressure, it is necessary to consider two cards taken simultaneously at either side of the piston.

This pressure is delivered to the crank pin minus the pressure necessary for the acceleration of the reciprocating masses during the first part of the stroke, plus the pressure liberated by the retardation of the reciprocating masses occurring toward the end of the stroke. With high-speed engines the influence of the reciprocating masses is very pronounced, and this influence does not appear on the indicator card. The torque delivered to the crank shaft is finally derived from the tangential component of the resultant pressure delivered to the crank pin. As the torque delivered to the crank shaft is the basis for the calculation of the weight of the flywheel, it follows that no calculation can be correct which does not consider the simultaneously existing pressures on either side of the piston, together with the influence of the reciprocating masses, and in case very accurate results are required, the friction. Considerations like those given by Mr. Hanchett lead to errors.

New York. F. Hymans.

Specialization in Electrical Engineering.

To the Editor of Electrical World:

SIR:—That electrical engineering in the older sense of the term has fallen into a somewhat parlous condition is a statement that appears to represent the present-day professional situation. As a general profession it is in much the same dismal case as mechanical and civil engineering in their turn. Time was when all three offered a promising career with many opportunities. In the days of swift competitive railway building men in the profession of civil engineering rose rapidly, if of any marked ability, and won a fair meed of fame and fortune. That day passed on and now, unless a young engineer is willing to chance it at the ends of the earth, his opportunities are not likely to lead him beyond a modest competence in a position of hard work and small renown. The average graduate in mechanical engineering likewise may commonly be found ten years after in a position of minor responsibility in the drafting-room, with the privilege of writing M.E. after his name as about the only thing to distinguish him from other and more humble wielders of the ruling pen. In electrical engineering the men who entered the profession a score of years ago had golden opportunities in the swift growth of the art and the multitude of electrical enterprises. Yet few of them have ever made the income won by the same class of ability in other pursuits, and even now one can count upon one's fingers all the electrical engineers who are winning the income, from strictly professional work, that falls to the lot of the successful lawyer. If the engineer gets rich it is usually because he has had the chance to mix financiering with his legitimate work in the proportion of about nine parts of the former to one of the latter.

We grant that this is not a cheerful outlook for the young man who believes that electricity is still in its infancy and needs him as a nurse. He can reasonably look forward to a decent livelihood, if he fancies the simple life, and to a respected position in the community, if it is not too large. If he is connected with a large concern and is charged with grave engineering responsibilities he may even get the salary of a competent traveling salesman in a wholesale dry-goods house. If his affiliations are less important his earnings are correspondingly smaller. He may perhaps find comfort in the thought that he is better rewarded than the average clergyman, whose mean pay is about that of an experienced street-car conductor. But the situation is really not helped by the comparison. The fact is that general engineering is about in the case of general anything else. There used to be an opportunity for the engineer as constructor of plants and designer of apparatus, but the contractor and the draftsman have ousted him. It does not take a high grade of capacity to take the catalogs of three or four prominent makers, pick out the one favored by the powers who finance and put together from the accepted list the necessary parts in faithful imitation of some recent plant of which blue prints are at hand. To be sure, the result may be costly, but it will be all the better from the standpoint of those who regard it merely as a raft upon which bonds are to be floated. The slightest departure from precedent is against the spirit of standardization and must be repressed.

The situation is undeniably bad, yet perhaps it is not by any means hopeless. There are a few electrical engineers who are successful in the practice of their profession, without any question and from any reasonable standpoint. They are to be found both in private work and in the higher ranks of great industries. It is not enough to retreat behind that dismal "bromide," "There is always room at the top." There isn't—at least for the man who is drearily crawling up the lower rungs with everyone above him heaving bricks. There is an extremely good reason for finding a man at the top. If one looks over the list of electrical engineers who belong to the first rank it will be found that practically every man has become a fairly well-defined specialist—a man who, letting the general work of the profession take care of itself, has won the reputation of doing some particular things better than anyone else.

The whole story is that electrical engineering has reached the stage that every art and science is bound to reach, in which general capacity is of far less moment than special insight into particular things. The profession as a whole is too big to be manageable and progresses line by line. It was one of Dr. Holmes' characters, if we remember aright, who could not in the least aspire to being called an entomologist, but might, if his labors were rewarded, be reckoned as a coleopterist. That is about the state in which the electrical engineer finds himself. He stands a very poor chance of fame or fortune if he has the temerity to spread his energies over too large a territory. He must make an attack in force at some point where it will tell and break his way through. And although the chance for this is denied to most men it is one that must be taken if it offers. At least, one may back out of a cul-de-sac and try it somewhere else. In no profession is the way easy; it means fighting from the drop of the hat and never giving up. In electrical engineering the chances are not of the best, yet they are as good probably as in other branches of engineering. They are best when they provide opportunity for work in some of the directions which lie off the well-worn track. The engineer is essentially a pioneer—who may be a splendid frontiersman, but often proves a mighty poor truck farmer when civilization really catches up with him. There are plenty of the truck-farming class among engineers, and the only chance for the pioneer is not to settle into competition with them, but to find a new frontier for himself and leave them behind, dawdling with their cabbages or their catalogs, while he seeks the passes into the undiscovered country.

CHARLES L. SOMERS.

Boston, Mass.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Boosting Poles.—R. POHL.—"Boosting poles" (Zusatzpole) are auxiliary poles arranged between the main poles of direct-current machines for the purpose of varying the voltage available at the brushes. This purpose distinguishes them from interpoles (Wendepole), which are employed for improving the commutation. However, both effects are sometimes intermixed. The author first discusses the use of boosting poles in direct-current rotary converters; the disadvantage of the fixed ratio of the two direct-current voltages of a converter is thereby overcome. In Fig. 1, N_1 may be the flux through a main pole, N_2 the flux of the boosting pole. The two sets of brushes AA and BB for the two armature windings are placed in the neutral zones. Then the useful flux for the brushes AA is

$$N_a = N_1 + N_2$$

and for the brushes

$$N_b = N_1 - N_2$$

A change of N_2 can therefore be used for varying the transformation ratio of voltages which is proportional to

the ratio of $N_1 + N_2$ to $N_1 - N_2$. If the boosting poles are provided with a shunt winding the dynamo voltage can be adjusted at will by means of a regulator in this winding. If a series winding is used (excited either by the motor

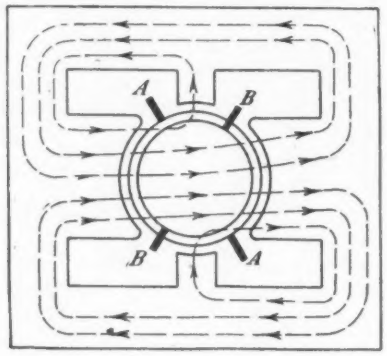
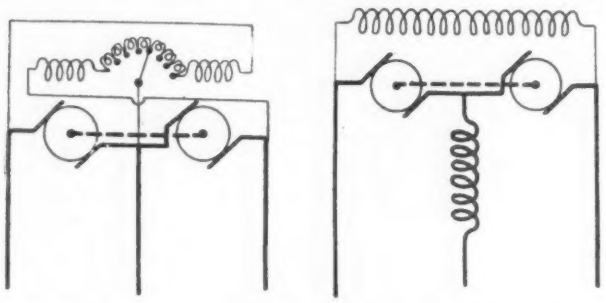


Fig. 1—Magnetic Circuits of Boosting Poles.

current or by the generator current) the dynamo side of the converter has the characteristic curve of a compounded or overcompounded machine. By using both a series and a shunt winding the no-load voltage may be adjusted at will and automatically maintained constant for any load. Finally, by reversing the direction of the current in the series winding of the boosting poles, a characteristic curve showing a rapid drop may be obtained as is desired, for instance, for automatic charging of accumulators. Boosting poles may also be employed in balancers for three-wire



Figs. 2 and 3—Shunt-Wound and Boosting-Pole Balancers.

systems. The connections of an ordinary balancer are shown in Fig. 2, those of balancers with boosting poles in Fig. 3 and Fig. 4, in which the boosting windings are indicated by heavy lines. There is a common field structure, but the armature is provided with two equal windings in series, connected across the outers. The boosting poles are either excited by the current in the neutral wire (Fig. 3) or are connected in equal halves in the two outers (Fig. 4). The accuracy of the voltage regulation in the two halves of the network can be adjusted by means of a shunt in parallel with the boosting pole winding. The application of the same principle to boosters is next discussed, but it

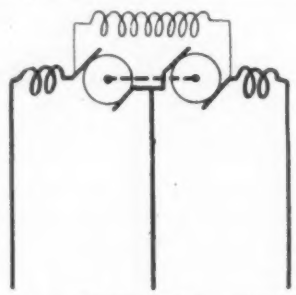


Fig. 4—Boosting-Pole Balancer.

is shown that it is unsuitable for charging accumulators and hardly practicable for feeders. Finally, the application to alternating-current and direct-current converters is discussed and the well-known split-pole converter is represented as a special case of the general machine with boosting poles.—*Elek. Zeit.*, Aug. 24.

Lack of Symmetry of Three-Phase Transformers.—W. Genkin.—An unloaded three-phase transformer with three iron cores, the axes of which are in the same plane, represents a non-symmetry in its magnetic circuit which manifests itself in a distortion of the electric equilibrium of the primary circuit. This phenomenon has a particular feature which may be seen by using the arrangement of Fig. 5, where A are ammeters; V, voltmeters, and W, wattmeters. The indications of the wattmeters will be found to change when the connections between the terminals 1, 2, 3 and 1′, 2′, 3′ are changed. But there exist only two systems of characteristic values according to the two directions of rotation of the vectors in such a manner that a simple

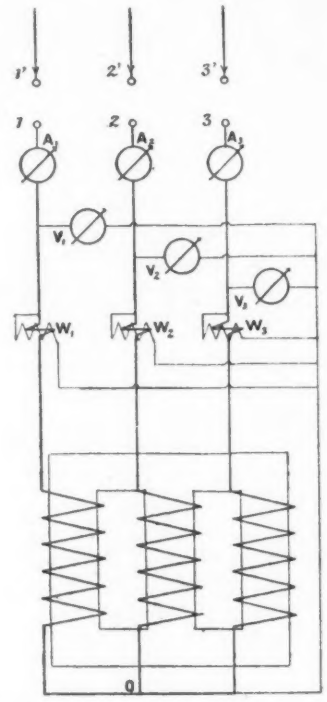


Fig. 5—Three-Phase Transformer Test Connections.

cyclic permutation of the terminals in the connections does not produce any change in the indications of the wattmeters.—*La Lumière Elec.*, July 15.

A General Property of Collector Rings.—E. Guillaume.—A mathematical paper in which the author compares the emf due to the rotation of the armature in its proper field with that due to the mutual induction between the short-circuited coils and the other coils and finds that the former is in all cases equal to the mean value of the latter.—*La Lumière Elec.*, July 15.

Lamps and Lighting.

Drawn Tungsten-Filament Lamp.—An illustrated description of the new tungsten lamp factory of the British Thomson-Houston Company. Until quite recently this factory was devoted to the manufacture of pressed-filament lamps, but developments have recently taken place resulting in the replacement of the old equipment by plant and apparatus for the manufacture of drawn-wire tungsten lamps in large quantities.—Lond. *Electrician*, Aug. 25.

Generation, Transmission and Distribution.

Conversion Factors for Power Cost Calculations.—Carl Hering.—An article giving two elaborate tables of conversion factors for power cost calculations. A distinction is made between a full year of 365¼ days of twenty-four hours each and a working year of 300 days of ten hours each. The first table gives the conversion factors for the different units of power and American money, while the second table gives the conversion factors for

different units of power and American and foreign money. —*Met. and Chem. Eng'ing, September.*

High-Tension Cable and Protection System for Cables. —H. BIRRENBACH AND M. HÖCHSTÄDTER.—An illustrated article on an extended new cable ring system around the city of Cologne in Germany. The total power of 10,000 kw-amperes is transmitted in the form of three-phase currents at 25,000 volts from a power station to a substation in a suburb of Cologne, where it is supplied directly to the cable system in the form of a ring passing through the suburbs. Transformer stations are provided in the different suburbs for reducing the voltage from 25,000 to 6000. For this ring-system three single-conductor cables are used. For the protection of cable systems a new method has been developed by M. Höchstädter, which is different from the Merz-Price system and which automatically disconnects any faulty cable part from the system. Fig. 6 shows the application of this system to a three-conductor cable carrying three-phase currents. The principal feature of this system is that around each copper conductor a_1, a_2 . . . a_6 a copper ribbon c_1, c_2 . . . c_6 is wound in spiral form which forms a concentric ring around the conductor. These copper ribbons c_1 . . . are isolated from the copper conductors a_1 . . . and in three-conductor cables these ribbons are also insulated from each other. Whenever the insulation breaks down at any point of the cable, for instance at the point x, where an arc develops between a conductor and the lead armor, then the arc represents (even if only for a very short time) a conducting connection between the copper conductor and the surrounding copper ribbon or between the copper ribbon and the lead armor, or it makes both connections at once. In this way a relay circuit of an auxiliary battery B connected with one pole to earth is closed and the relay coil R_1 or R_2 operates the switch S_1 or S_2 so as to cut off the cable portion on which the fault has developed. The switch is thus at once closed. Exactly the same thing happens at the other end of the faulty portion of the cable, so that this portion is separated from the network at both ends, while all other switches are not actuated and all other cable portions remain in circuit. In the case of a breakdown

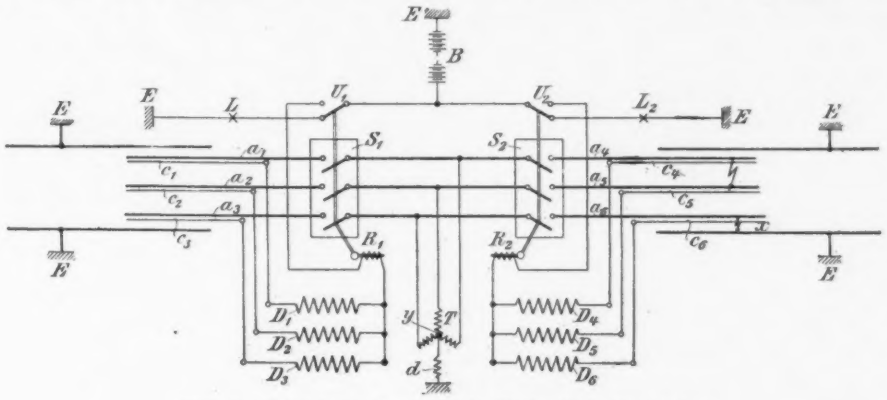


Fig. 6—Arrangement of Cable-Protecting Apparatus.

between two conductors, for instance a_4 and a_5, which does not effect the lead armor, the arrangement acts as follows. The different phases, or if transformers are used the neutral points y of these transformers, are connected in one or more stations through choking coils D to earth. The battery current then passes from the protective copper ribbon through the arc to one or two of the conductors and then through the earth connection referred to into the earth and back to the battery. In the connections between the spirals c_1 and c_6 and the relay coils of the switches S_1 and S_2 choking coils D_1 and D_6 are connected in star fashion. They have a small ohmic resistance for the battery current, while in normal operation as well as in the case of a breakdown they suppress the alternating current which would flow otherwise through the copper ribbon spiral. A detailed description is then given of the construction of the cables for the Cologne system. The cable construction is shown in Fig. 7, where 7 is the copper conductor of 95 sq. mm cross-section, 6 is the paper insulation of 8 mm thickness, 5 is the protective spiral of copper ribbon, 4 is paper insulation of 2.55 mm thickness, 3 is the lead armoring, 2 is a double layer of paper impregnated with asphalt and 1 is the external jute layer. The specifications of the cable are given and the method of testing is described in detail.—*Elek. Zeit.*, Aug. 10 and 17.

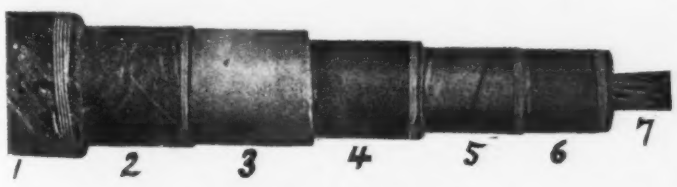


Fig. 7—Details of Cable.

Swiss Water-Power Plant.—An illustrated description of the Schaffhausen water-power plant. Since the night load is very light and no water storage is possible near the works a pumping station has been arranged. A motor generator which is alternately used as motor and as generator carries at one end of its shaft a high-pressure water turbine and at the other end a centrifugal pump. During the night the motor receives electrical energy from the station and drives the centrifugal pumps, which deliver water to a high-level reservoir 2.1 km (1¼ mile) distant. During the times of peak load in the daytime water flows back from the reservoir and drives the turbines, which again drive the generators and thus supply electric energy to the transmission network. The overflow level of the reservoir is 155 m above the pumps. In view of the friction, mechanical and electrical losses in the different machines the overhaul efficiency is not more than 42 per cent. The capital investment in this storage plant has been high on account of the long, expensive pipe line.—Lond. *Elec. Review*, Aug. 18.

Traction.

Glasgow Tramway System.—An abstract of the last annual report of the municipal tramway system of Glasgow. The receipts, which a year ago were $4,483,600, have risen to $4,747,445, an increase of $263,845. The working expenses rose only by $151,340 to $2,665,895. This resulted in a greater contribution to the "common good," namely, $343,390, as against $265,140 in the previous year. The cost per car-mile was made up as follows: Traffic expenses, 5.98 cents; general expenses, 2.32 cents; repairs and maintenance, 2.66; energy, 0.84; capital charges, 8.64; hence total expenses, 20.4 cents. The total revenue per car-mile was 21.96 cents.—*Lond. Electrician*, Aug. 25.

Paris Subway.—An illustrated article on the opening of the new electric subway in Paris, the North-South Line, which is an entirely distinct enterprise from the old Metropolitan subway. Motor cars and trailers of the same general appearance as those employed on the Metropolitan are also used on this line, though there are some differences in detail. One of the main differences in operating the trains lies in the use of the track rails as an earthed neutral conductor and the employment of both a third-rail and overhead trolley wire for supplying energy to the motors. In the case of two 600-volt, direct-current motors, which is the standard equipment per train here as well as on the other subway, one motor is supplied from the third-rail,

returning to the track or earth, and the second from the trolley to earth, using 1200 volts between the third-rail and trolley. To keep the voltage constant at 600 volts on each motor the balance is maintained by the multiple-unit control apparatus on the motor cars. As this does not allow the use of an uneven number of motor cars (three cars are sometimes used on the other line) the capacity of the motors is increased, so as to make them capable of drawing the maximum train load with two motor cars in all cases. Each motor car thus carries four motors, each of 125 hp. Economy in wiring over the 600-volt system is secured by the use of a pressure of 1200 volts and there will be less earth leakage. The energy is brought in bulk from existing central stations and transmitted in the form of three-phase currents at 10,000 volts to 15,000 volts to two substations. Each of the substations is equipped with transformers and rotary converters, from where 12,000-volt direct current is supplied to the line. Owing to the short length of the subway (9 miles) not more than two substations were needed.—*Lond. Electrician,* Aug. 25.

Wires, Wiring and Conduits.

Wiring System.—G. Graf.—An illustrated paper read before the German Association of Electrical Engineers on a universal system of wiring and fittings which can be used in workshops of any kind. It has been developed by the Allgemeine Electricitäts Gesellschaft.—*Elek. Zeit.,* Aug. 24.

Wiring.—P. Stern.—A paper presented before the German Association of Electrical Engineers on the esthetics of electric wiring. He discusses in detail how the wiring installations in a house can beautify it or distract from its appearance.—*Elek. Zeit.,* Aug. 10 and 17.

Electrophysics and Magnetism.

Energy and Temperature.—Max Planck.—A lecture presented before the French Physical Society on the relation between energy and temperature. According to the viewpoint of pure energetics the temperature is a factor of the energy, the relation between temperature and heat energy being the same as between mechanical force and mechanical work or between electric potential and electrical energy; the temperature difference between bodies determines the direction in which heat will pass from one to the other in the same way as the potential difference determines the direction of an electric current. But such a view is too narrow, as it ignores the one essential point that mechanical motion is possible in a direction opposite to a mechanical force; that an electric current can be made to flow in a direction opposite to a potential difference, while a stream of heat energy opposite to temperature drop is absolutely impossible. To solve the problem of the relation between temperature and energy not even the second principle of thermodynamics is sufficient, but atomic and molecular conceptions must be taken into account. According to the kinetic gas theory, the temperature of a perfect gas is represented by the mean energy of the progressive motion of a single gas molecule, independent of its molecular weight. This simple rule seems to permit an answer to the question as to the relation between energy and temperature. For it seems easy to generalize this rule so as to apply to imperfect gases, vapors, liquids and solids. It is only necessary to assume that temperature equilibrium between two bodies is obtained when the different molecules of the two bodies in contact with each other have the same mean energy of motion. From Hamilton's general equations of motion, with the aid of probability calculations, Boltzmann and Gibbs have succeeded in deriving a general theorem which is called the principle of uniform distribution of energy. A consequence of this theorem is the conception that the temperature of a body is a measure of the mean kinetic energy of any velocity component of any of its molecules. The Boltzmann-Gibbs theorem has assumed, in the opinion of many, the rank of a fundamental principle of thermodynamics, and it has indeed been confirmed in various special applications, especially to monatomic gases. However, the present author shows in great detail that this principle cannot be upheld in general. He traces the different steps in the mathematical deduction of the Gibbs-Boltzmann theorem and investigates at which point a correction must be applied. This he finds necessary with respect to the assumption of the number of independent degrees of freedom with which the different atoms, ions and electrons move in a molecule containing several atoms. He concludes that it is wrong to assume that all the different constituents of a molecule are "free" and that it is necessary to assume that the number of degrees of freedom in a molecule is smaller, often much smaller, than the number of the constituents of the molecule. To justify such an assumption a new hypothesis is required. The author's fundamental new hypothesis is that the rapid oscillations within a molecule, which cause the absorption and emission of radiant heat, cannot have any amount of energy, but that their energy must be necessarily a multiple of a finite unit quantity of energy which depends on the frequency. This hypothesis of energy made up of unit quantities leads to a mathematical equation which contradicts the Gibbs-Boltzmann theorem in general. While the author thinks that the new hypothesis can still be improved in details, yet it has already proved very useful as a working hypothesis in many directions.—*Phys. Zeit.,* Aug. 15.

Resistance and Emf of Selenium.—J. Luterbacher.—An investigation of the phenomenon of the decrease of the resistance of a selenium cell with the emf. In all the tests the variations due to illuminations and heating were eliminated by keeping the cells for several days together at a temperature of melting ice and in absolute darkness. The author calls the effect the "voltage effect" or "tension effect." It had the same sense, that of an increase of conductivity with rising emf, in all cells except one, which showed an inversion. The voltage effect is greater with

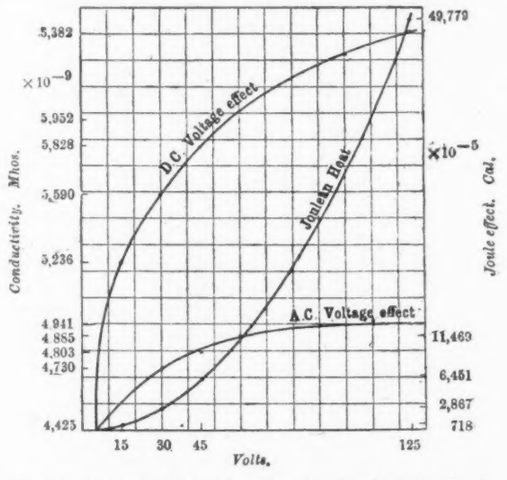


Fig. 8—Voltage Effect Compared with Joulean Heat.

direct current than with alternating currents. There is in general no proportionality between the applied voltage and the voltage effect, a given difference in voltage being less effective at high voltages. The voltage effect is not instantaneous, nor does it disappear at once after taking off the high emf. The time of recovery increases in general with the voltage and the time during which it is applied. The photoelectric sensitiveness is not affected in any way by the voltage effect. That the Joulean heating is not the cause of the voltage effect is shown by the aspect of the curves of Fig. 8, which show that the Joule effect increases very slowly at low voltages, whereas the voltage effect rises abruptly even for alternating currents. Besides,

if the Joule effect were the cause, there is no explanation for the difference between the direct-current and alternating-current curves. On cutting off the voltage abruptly and letting the selenium cells discharge through the galvanometer, a polarization of from 7 to 22 millovolts was observed for a few seconds. The author suggests that this polarization (always in the same direction as the original current) may be much stronger when the current is on and may thus explain the voltage effect.—Abstracted from *Ann. d. Physik* in Lond. *Electrician,* Aug. 18.

Increase of Magnetic Induction in Nickel Bars Due to Transverse Joints.—E. H. WILLIAMS.—The magnetization of very thin layers of iron is much weaker than that of greater masses, whereas in the case of nickel the opposite is true—that is, thin layers are much more strongly magnetic than thick layers. The influence of a plane of transverse section on the magnetic induction of an iron bar is to produce a large magnetic resistance which, however, can be reduced by longitudinal pressure. Now, if the surface layers of nickel are more strongly magnetic than the mass of nickel, it would seem that in this metal transverse joints would tend to increase the magnetic induction rather than decrease it as in the case of iron. The author has determined the effects of surface layers in bar magnets of iron and of nickel, produced by cutting the bar in planes of transverse section under various conditions of field strength and longitudinal pressure. The results show that the effect of transverse sections on the magnetic induction is always a negative quantity in the case of iron—that is, that transverse joints in a bar of iron tend always to decrease the magnetic induction by increasing the magnetic resistance. In the case of nickel the results are very different. Beyond magnetic fields of twenty or twenty-five lines per square centimeter the per cent change is a positive quantity—that is, the effect of transverse joints is to increase the magnetic induction. However, the curve giving the increase of magnetization as a function of the magnetizing force reaches a maximum value at a certain point, and it is evident that the effect of the surface layers is due to two or more causes and that it does not follow any simple law.—*Phys. Review,* July.

Previous Magnetic History and Temperature.—E. WILSON AND L. C. BUDD.—A paper presented before the Physical Society in London. The effects of previous magnetic history upon permeability and hysteresis have already been studied at ordinary atmospheric temperature. The object of the present paper is to examine the effect of variation of temperature upon the influence of wide previous history. The conclusion is that the influence of large previous magnetic history in a 3 per cent silicon alloy of iron is seriously affected by variation of temperature, being largest at the low temperatures and ultimately becoming very small, if not vanishing, at the point near which the material becomes non-magnetic. In addition, both heating and cooling have permanent effects upon the magnetic quality of this alloy. Previous heat treatment must also be considered.—Lond. *Electrician,* Aug. 18.

Electrochemistry and Batteries.

Electric Tin Smelting.—J. HARDEN.—An account of a trial made recently in England with electric tin smelting on a commercial scale. From the figures given it would appear that a saving in tin could be effected by means of electric smelting if energy could be obtained at a reasonable rate. The process is thought to be applicable to the Straits Settlements.—*Met. and Chem. Eng'ing,* September.

Refining of Silver and Gold Alloys.—E. F. KERN.—A paper illustrated by diagrams giving a concise summary of the different methods in commercial use for the refining of silver and gold alloys. He first gives a review of the parting of Dore bullion with boiling concentrated sulphuric acid and of the electrolytic process of parting bullion, both the Moebius cell and the Balbach-Thum cell being described and illustrated. The treatment of the silver anode sludge, either by a chemical method or by an electrolytic method, is next taken up. The second part of the article deals with electrolytic refining of gold by the Wohlwill process and the use of a pulsating current in this process. —*Met. and Chem. Eng'ing,* September.

Units, Measurements and Instruments.

Field and Flux.—F. EMDE, BRYON AND HERRMANN.—Three letters on the distinction between field and flux. Emde emphasizes that the field is a space and cannot be measured numerically. The flux can be measured numerically. In a transformer the iron core is the main field and the stray field is between the primary and secondary circuits. But we must say that the stray flux is 5 per cent of the main flux and that the fluxes through different cross-sections of the same pole are different on account of the stray fluxes, while all these cross-sections are situated in the same field. Herrmann thinks that field and flux are about the same and he does not like to use the term flux because he wants to avoid the idea in students that anything is flowing.—*Elek. Zeit.,* Aug. 10.

Meters at Varying Voltages.—W. GENKIN AND A. SCHILLES.—A description, illustrated by numerous diagrams, of a graphical method which permits one to determine easily the errors of the readings of a meter due to fluctuation of voltage. By properly selecting the field strength of the permanent magnet of the meter these errors can be maintained within given limits.—*La Lumière Elec.,* July 8.

Analysis of Periodic Curves.—J. F. ANDOUIN.—A paper on the resolution of a periodic wave into a Fourier series of sine waves. Graphical methods of analysis permit one to get great accuracy only with difficulty and do not indicate how approximately the results are true. Among arithmetic methods the author deals especially with the new method of Schleiermacher, described in his recent German paper, and shows how it simplifies the calculations. The simplifications are such as to make the multiplications less troublesome by a judicious choice of the number and the position of the ordinates under consideration.—*La Lumière Elec.,* July 15.

Telegraphy, Telephony and Signals.

Recent Telephone Systems.—C. L. VAN DER BILT.—The author emphasizes that a comparison between manual, semi-automatic and automatic exchanges is by no means simple, since manual systems do not represent a well-defined group. He thinks that among the manual system the so-called "distribution systems" (Verteilersysteme) are not sufficiently taken into consideration, although they are best adapted to save attendance and insure quick service. The purpose of such systems is to distribute the work of the operators as uniformly as possible over all of them. For this purpose two departments are provided. The first is called the distribution department and its purpose is to turn over all call-ups as quickly as possible to those operators in the second department, called the connection department, who are free at that moment. The operators in the second department test the desired connections and make the connection. A good many statistical data are given from the experience with such a system in a European exchange and figures are given on first cost and cost of operation. A comparison is made with semi-automatic and automatic systems; it is thought that the latter should be used only in a system comprising several exchanges and especially in sub-exchanges. In general the semi-automatic system is considered to be preferable. The advantages of careful compilation of statistical data are pointed out.—*Elek. Zeit.,* June 29 and July 6.

Tuning of Antennas.—A. GUYAN.—A paper giving the mathematical theory of the effect of a self-inductance and a capacity inserted at the base of a single-vertical-wire antenna.—*La Lumière Elec.,* July 8.

New Apparatus and Appliances

MILWAUKEE MANUFACTURERS' EXPOSITION.

Beginning Sept. 2 and scheduled to be closed Sept. 12, the Manufacturers' Exposition of Milwaukee-made products was held in the Auditorium Building, Milwaukee, Wis. The display was an interesting one and to many visitors it

Fig. 1—Interior View of Main Arena Floor at Milwaukee Manufacturers' Exposition.

was a revelation of Milwaukee's varied manufacturing interests. Several of the exhibits were of an electrical nature or related to the electrical display, and the following paragraphs are devoted to features of the exposition of especial interest to readers of this journal. It may be noted that the Auditorium in which the exposition was held is a comparatively new building especially erected for events of this kind and one which is spacious, carefully constructed and well adapted to different gatherings of this character. The attendance was good and at night the streets leading to the Auditorium were made conspicuous by arches of incandescent lamps erected by the Milwaukee Electric Railway & Light Company. The exhibition was given in celebration of the fiftieth anniversary of the Merchants and Manufacturers' Association. Mr. Otto H. Falk is president of this association and Mr. C. N. Duffy, general sales agent of the Milwaukee Electric Railway & Light Company, is chairman of the committee on industrial exposition. There is also a publicity and poster committee, of which Mr. C. L. Benjamin, of the Cutler-Hammer Manufacturing Company, is a member.

Centrally located in a graceful open pavilion surmounted by a large ball made of incandescent electric lamps was the display of the Milwaukee Electric Railway & Light Company. This exhibit constituted the most prominent display of electric lighting at the exposition, although the hanging-basket effect in lighting fixtures, illustrated clearly in the accompanying picture, was also effective. The Milwaukee Electric Railway & Light Company supplies the street-railway service and the major portion of the electric light and power service of Milwaukee. Its exhibition consisted mainly of devices intended to demonstrate the uses of electrical energy for industrial purposes. One conspicuous mechanism was a working exhibit of Cutler-Hammer automatic controllers for 50-hp direct-current motors used for driving pumps of hydraulic elevators, illustrating the equipment in the Hotel Pfister, lately taken over by the central-station company. Another exhibit was a mercury-arc rectifier and panel intended to illustrate the simplicity of the apparatus for charging storage batteries for electric vehicles—a branch of the business which is being pushed in Milwaukee. Incidentally, the rectifier was utilized to obtain direct current for use in the exhibit, as the building is supplied with 60-cycle alternating current. The direct current was used for the operation of various motors which were employed for demonstrating purposes and which did not, of course, carry heavy load. However, the use of a mercury-arc rectifier to supply energy for the operation of direct-current motors is unusual, and therefore this application was of especial interest to electrical men. There were several other industrial demonstrations, including a small blacksmith's forge electrically operated and various pumps and blowers.

Of much popular interest was a model of an airship suspended from the roof and equipped for control by means of electrical energy transmitted by Hertzian waves from a "wireless" sending station in a balcony. This interesting exhibit was in charge of the School of Engineering of Milwaukee.

Allis-Chalmers Company displayed both portable and stationary electrically driven air compressors. Several transformers were also shown, as well as some small motors.

Julius Andrae & Sons Company exhibited telephonic supplies and electric motors, as well as a country lighting set consisting of a small dynamo, storage battery and a switchboard panel with the necessary instruments.

Battery, Light & Power Company displayed its storage-battery lighting system for country homes. This company makes storage batteries and also supplies complete lighting outfits of small size.

Cutler-Hammer Manufacturing Company devoted its interesting exhibit largely to various forms of electric heating and cooking appliances, although there was also a dis-

Fig. 2—View of Typical Booth at Milwaukee Manufacturers' Exposition, with Glimpse of Wirelessly Operated Airship Model Overhead.

play of push-button switches. Women demonstrators illustrated the use of electric flatirons and disk stoves.

The Falk Company, among other machinery, showed a 10-hp kerosene engine coupled to a dynamo of like rating. Electrical energy from this set was used for operating in-

candescent lamps placed around the exhibit and also a motor-driven machine employed to demonstrate the double helical gears made by this company.

H. W. Johns-Manville Company displayed fuses, fiber conduit, tapes and splicing compounds, electrotherm, linolite, etc.

Mechanical Appliance Company exhibited Watson motors of various sizes and for various applications. Both direct-current and alternating-current motors were displayed, and an electric riveter shown in operation was a prominent feature.

National Brake & Electric Company displayed air-brake equipment and air compressors.

Northwestern Manufacturing Company exhibited its dynamos and motors in the Andrae exhibit.

Pawling & Harnischfeger Company had an interesting machinery exhibit made up of several types of electrically operated hoists. A two-motor hoist arranged for cage and floor control and a recently designed lumber conveyor were features.

Vilter Manufacturing Company attracted attention by an educational exhibit showing the practical use of electrically operated ice-making and refrigerating machines. A "refrigerated sign" was a striking feature of this exhibit.

INDUCTION MOTOR CONTROLLER.

The type of reversing controller for induction motors which has been hitherto mostly favored for colliery and similar work is the one in which use is made of a revolving drum on which are carried various contacts. The cost of maintenance of the drum controller is considerable, and to this must be added the fact that small replacements, however trivial in cost, cause a large amount of inconvenience and attendant expense.

It would appear that a type of controller which would avoid any excessive wear on contacts and give at the same time a positive action would appeal to motor users. In the controller illustrated herewith use is made of a contactor system which gives a quick break-and-make action and maintains the surfaces smooth and clean and at the same time causes a minimum of wear on the contacts.

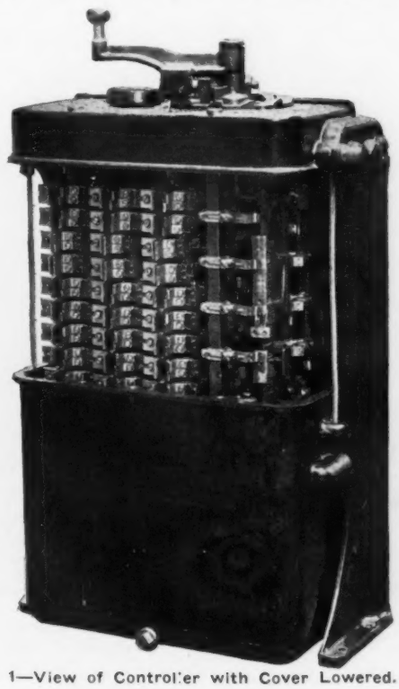


Fig. 1—View of Controller with Cover Lowered.

Referring more particularly to the most important improvement in the controller, namely, the method of making contact, it will be seen from Fig. 3 that there is a fixed frame on which are carried the spindles A_1, which extend almost the entire height of the controller. Pivoted on each of these spindles are movable arms A_2, to which are

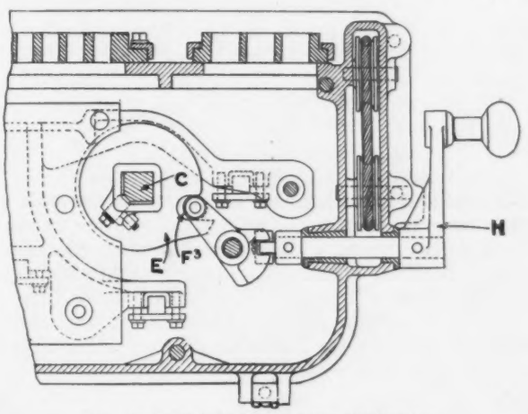


Fig. 2—Details of Reversing Mechanism.

fixed contacts A_3, each spindle carrying the number of arms with contacts corresponding with the steps of the rotor resistor, of which there are usually nine. These arms have a rotating movement on the spindle and also a small lateral movement, the combination of these movements insuring that the contact pieces shall approach one another (when making circuit) at such an angle as to insure a good wiping action contact. Corresponding with, and registering horizontally to, these contacts A_3 are the same number of fixed contact pieces B_1. These contact pieces are mounted on vertical standards B, but are insulated therefrom by mica.

Each of the movable contact pieces A_3 is held extended to the left by means of a spring, the spring movement being limited by blocks A_5. This addition insures that in each case when contact is made between the two contact pieces A_3 and B_1 any wear or unevenness of alignment relative to one another will not cause sparking as in the closed position, perfect contact being made against the full compression of this spring. It will be seen from Fig. 3 that a main operating pillar C, actuated by means of the controller handle, carries a number of cams, each cam being

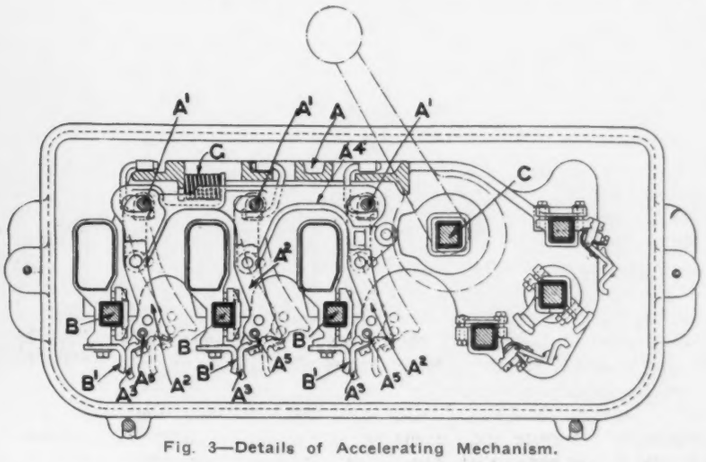


Fig. 3—Details of Accelerating Mechanism.

appropriated by one of the movable cradles A_4, on which are pivoted the movable contact arms A_2.

At the top of the operating pillar, just below the handle, is a cam E, Fig. 2, in which there is a recess into which projects a roller F_3. The first operation of the main con-

troller handle moves the cam E in a clockwise direction, carrying the arm F_3 with it through an angle of about 50 deg. in a counter-clockwise direction, at which point the roller leaves the recess in the cam and the primary circuits are closed, as may be seen by referring to Fig. 3, and the motor is connected to the line with all resistances in circuit. An extension of arm F_3 at the same time enters a slot formed in the end of the spindle of the reversing handle H (Fig. 2), thereby locking it in position. When bringing the controller arm back to the "off" position the tooth shown on the cam E engages with the roller on arm F and brings it back into the position shown in Fig. 2, thereby opening the primary circuits and unlocking the reversing handle.

The next and following notches actuate the movable contacts in turn, moving them forward through the necessary path to make contact with the fixed contact pieces. An automatic notching device, also attached to the handle, prevents the operator from moving forward more than one notch at a time. The time automatically allowed between the notches permits the motor to accelerate the requisite amount before it is possible to pass to the notch next in order.

For starting up the motor in the opposite direction use is made of the handle H, the movement of which raises or lowers the reversing drum so that the primary connections are reversed. The reversing handle is locked in position by the first movement of the controller handle. Moreover, the controller handle is locked by the reversing handle in any intermediate position of the latter.

In order to facilitate the examination of the contact drum the casing of the controller has been arranged to move vertically up and down in guides, as shown in Fig. 1, which illustrates the cover in the down position. The whole of the weight of the casing, including the oil, is balanced by a counterweight. All of the current-carrying parts are immersed in oil and the lowering of the controller case which contains the oil leaves the contacts exposed and at a convenient height for inspection or repair.

The above-described controllers have been developed for the market by Dick, Kerr & Company, Ltd., Abchurch Yard, Cannon Street, London, England.

EXHIBITS AT PENNSYLVANIA CONVENTION.

Manufacturers and supply men took advantage of the convention of the Pennsylvania Electric Association at Exposition Park, Pa., Sept. 5 to 9, to make an unofficial display of their wares or to send representatives to interest the central-station men present in their particular products. The General Electric Company and the Simplex Electric Heating Company made exhibits in the rear of the convention hall, the one displaying heating apparatus, motors, lamps, an ozonizer, etc., and the other making a display of irons and cooking devices. The former company was represented by the following: Messrs. J. M. Hayes, J. Hamilton, W. H. Cogswell, C. A. Raymond, W. H. Rue, W. L. Mason, E. W. Howard, J. J. Lills, J. E. Hill and C. C. Supplee. The Simplex Electric Heating Company was represented by Mr. E. B. Stebbins. Outside of the convention hall and under the dancing pavilion were a number of electric signs displayed by the Federal Sign System (Electric). The representatives of this company were Messrs. W. A. Williamson, W. H. Fry and R. W. Sullivan.

The Westinghouse Electric & Manufacturing Company chartered the steamer *Helena*, upon which it placed its exhibit. The boat, which was also placed at the disposal of the association for sails on Conneaut Lake, was decorated with incandescent lamps, the decorations including a keystone outlined in lamps. The exhibit included a complete line of electric cooking and heating apparatus, instruments, transformers, motors, lightning arresters, etc. The company was represented by the following: Messrs. J. C. McQuiston, T. F. Foster, W. Barnes, Jr., L. L. Warfield, C. E. Stephens, S. A. Fletcher, W. B. Underwood, T. J. Pace, T. A. McDowell, A. M. Dudley, W. F. Fowler, J. Andrews, G. H. Criss, W. B. Wilkinson, M. M. Barr, L. A. Starrett, W. G. Miles, J. M. Ireland, H. M. Gansman, M. C. Morrow, V. E. Cohen and L. T. Peck. Mr. B. F. Fisher, Jr., was the representative of the Westinghouse Lamp Company.

On the veranda of the hotel a number of houses made exhibits. The Philadelphia Electrical & Manufacturing Company displayed absolute cut-outs and arc cut-outs, tungsten lamps and street-lighting fixtures, conduit sealing plugs and malleable pole and line hardware. Messrs. W. H. N. Ward and W. O. Dale were in attendance. W. N. Matthews & Brother, St. Louis, exhibited sample lamp guards, clamps, lamp changer and fuse switch. Mr. V. L. Crawford represented the firm. The Crouse-Hinds Company, Syracuse, displayed a sample meter panel and distributed printed matter on condulets. Mr. M. J. Kiefer represented the company. The H. W. Johns-Manville Company made a display of "noark" service and subway boxes, friction tape, splicing compound, "solderall" and fiber conduit. Messrs. P. C. McCutcheon and H. N. Voorhis were the representatives in attendance.

The Pittsburgh Transformer Company had on display a number of bell-ringing transformers, a large transformer and parts of its series street-lighting system. Mr. H. G. Steele represented the company. Hubbard & Company exhibited photographs of the Mueller system of secondary distribution, hinged arms for tungsten street lamps, secondary racks, spreader brackets, clamp pins, Pierce brackets, hammer drill, expansion bolts, etc. Mr. C. L. Pierce, Jr., represented the company. National Metal Moulding Company showed samples of its "sherarduct," "flexsteel" conduit and armored conductor and "flexduct." Mr. C. B. Cushing was in attendance. The H. T. Paiste Company placed on exhibition samples of its standardized and interchangeable porcelain and iron conduit fittings in charge of Mr. W. M. Winship.

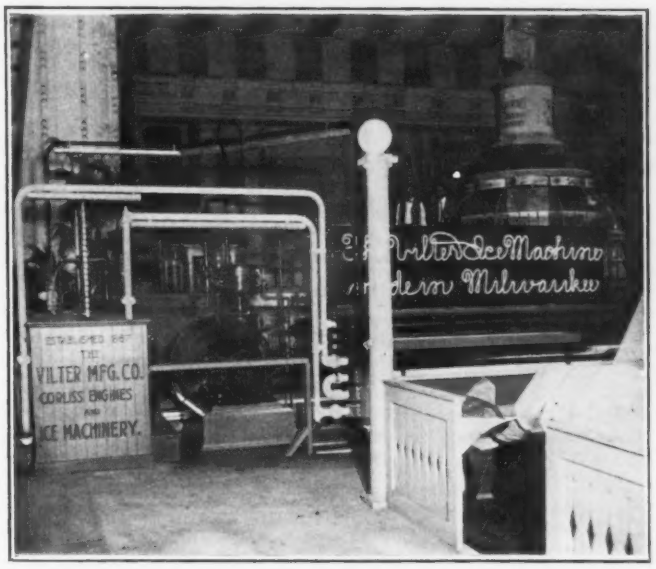
Among the various other companies having exhibits on the hotel veranda were the Duplex Metals Company, sample case of its products; Sangamo Electric Company, meters; Pittsburgh High-Voltage Insulator Company, porcelain insulators and cut-outs. Companies represented at the convention but not making exhibits were as follows: Allis-Chalmers Company, Messrs. J. B. Nicholson and S. H. Payne; Art Brass & Fixture Company, Mr. L. R. Jeffords; American Conduit Manufacturing Company, Mr. R. W. Jaynes; American District Steam Company, Messrs. C. R. Bishop and W. J. Kline; Buckeye Electric Company, Messrs. F. C. Foster, J. M. Smith, C. I. Barry and H. D. Porter; Bryan-Marsh Company, Mr. D. E. Eyman; Crocker-Wheeler Company, Messrs. R. H. Smith, J. O. Stanick and W. F. Ficklen; Cleveland Electric Supply Company, Mr. M. L. Baher; Doubleday-Hill Electric Company, Messrs. W. D. Shaler, C. P. Hill, E. Reynolds and J. G. Atwell; Excess Indicator Company, Mr. W. L. Loeb; Elliott Lewis Company, Mr. T. E. Roger; Eureka Vacuum Cleaner Company, Mr. C. H. Johnson; Frick & Lindsay Company, Mr. J. W. Smyth; General Vehicle Company, Mr. W. White; Ludwig Hommel & Company, Messrs. L. Hommel and F. R. Jennings; Holophane Company, Mr. T. E. Mansfield; Iron City Electric Company, Messrs. C. L. Corbin, R. C. Murdock and J. R. Boher; Miller-Owen Electric Company, Mr. F. C. Owen; Novelty Electric Company, Mr. K. C. Sadler, Jr.; Ohio Brass Company, Mr. N. Shute; Pittsburgh Pole Reinforcing Company, Mr. W. A. McCombs; Robertson Cataract Company, T. E. Devine; J. A. Roebling's Sons Company, Mr. R. J. Smith; Rumsey Electric Company, Messrs. J. H. Burroughs and D. C. Anderson; Raphael Electric Company, Mr. H. M. Raphael; Stand-

ard Underground Cable Company, Mr. E. Kerschner; F. H. Stewart Electric Company, Messrs. J. S. Connell and W. T. Walker; Safety Armorite Conduit Company, Mr. R. M. Morris; Union Electric Company, Messrs. J. W. Disbrow and P. H. Schaum; Wall-Winn Company, Mr. B. Wall; Wagner Electric Manufacturing Company, Messrs. J. Mustard and C. F. Succop; Western Electric Company, Messrs. F. C. Jaeger, J. Sigg, E. E. Hedler, C. B. Price, W. C. Robinson, N. C. Owen, J. R. Stuard, J. S. Rogers and C. R. Lepper.

A REFRIGERATED SIGN.

At the recent Manufacturers' Exposition in Milwaukee one of the conspicuous exhibits was that of the Vilter Manufacturing Company, which showed in operation, for the purpose of educating visitors, an electrically operated ice-making machine and refrigerating equipment. A striking feature of this exhibit was a "refrigerated sign," which is clearly shown in the accompanying illustration. This sign was made up of about 100 ft. of ½-in. iron tubing forming the words, "Vilter ice machine, made in Milwaukee," and arranged on a black background. This line of pipe formed a part of the working refrigerating exhibit, and, becoming frosted on the outside, stood out in white before the black background in a very effective manner, using the refrigerating machine for sign work in a unique and effective way.

The exhibit included a vertical single-acting ammonia compressor of the inclosed type belted to an 8-hp electric motor. The compressor is rated at 5 tons refrigerating capacity, or 3 tons ice-making capacity, a day. Ice was manufactured by this equipment every day, and fish, fruit, flowers and other objects were frozen in solid blocks of ice for the admiration of visitors, who bestowed a great deal of attention on this interesting exhibit. The machine, as exhibited, was operated to produce about 1 ton of ice daily, the remainder of its capacity being utilized for refrigeration. The installation also included a double-pipe brine cooler, the pipe being used to form the dividing line or fence for the exhibit, and it also was frosted like the piping



Refrigerated Sign in Exhibit at Milwaukee Manufacturers' Exposition.

in the sign. The brine pump was driven by a 1-hp motor.

In the rear of the exhibit of the Vilter Manufacturing Company was the collective exhibit of the Milwaukee brewing industry, and the Vilter Company also displayed a number of its appliances in connection with the large brewing exhibit.

ELECTRIC CEILING FIXTURE.

The Tungstolier Company, of Conneaut, Ohio, has brought out a new fixture known by the trade name T. T. C. fixture, which is made on the sectional principle and consists of a number of interchangeable parts—a wireless body, wireless arms, bottom shell and canopy.

The wireless body has a number of holes around its circumference, so arranged that arms may be inserted to make

Fig. 1—Two-Lamp Fixture.

a two-arm, three-arm, four-arm or six-arm fixture. The holes not occupied by the arms are covered with a neat cap that screws on. The arms are ready wired and have a patented spring clip that engages the contacts in the wireless body, so that to attach an arm it is simply pushed into one of the holes and locked fast with a baffle nut which screws up with the finger and thumb.

Any one of six different types or designs of bottom shell may be used, ranging in depth from 2 in. to 10 in., and instead of being attached to piping they fasten with two screws to the side of the body and may be changed in less than a minute. The canopies are of the standard type, but are supplied in styles to harmonize with the designs of the arms and body shells.

Among the advantages to central stations and contractors claimed for the new tungstolier are that with two fixture

Fig. 2—Four-Lamp Fixture.

bodies, eighteen styles of arm (four of each style), six styles of body shell and six canopies one may build up no less than 1944 different and individual fixtures; that any style of fixture can be assembled in two minutes, and that the customer can be shown a practically unlimited assortment with a stock consisting of only eighty-six parts.

Industrial and Commercial News

The Week in Trade.

MODERATE expansion continues to be shown in the volume of business throughout the country, and the attitude toward future commitments is less conservative than has been the case for some time past. There have been a number of favorable developments in the past week, and these have assisted in promoting confidence. Among them is resumption of work at many textile mills in New England, indicating growth of trade, and affording employment to thousands of operatives; there is a better outlook for adjustment of labor differences in many of the industries, and particularly the disputes on the Western railroads, and the season of the year is opportune for advancement in trade. In nearly every line some improvement has been made since the end of summer. A decided expansion has taken place in retail trade, due to the change of season. The monthly statement of the Steel Corporation showed unfilled orders as of Aug. 31 of 3,695,985 tons, representing an increase of 111,900 tons over the July report. A temporary decrease has taken place, however, in the volume of new orders in the iron and steel trades, and owing to the mild response to the recent cut in wire products shading is becoming more general. Tonnages on several of the railroads, particularly those in the West, are slightly heavier than at this time last year, and further decrease is reported in the number of idle cars. Earnings, however, are not satisfactory, operating expenses being large, and not in proportion to the freight handled. Movement of crops, foodstuffs and live stock is becoming more pronounced, and prospects appear good for early increase in the volume of business now handled by many of the roads. Business failures for the week ended Sept. 7, as reported by *Bradstreet's*, were 194, as compared with 164 last week, 173 for the corresponding week in 1910, 191 in 1909, 191 in 1908 and 172 in 1907.

The Copper Market.

DECREASE of 4,297,397 lb. in copper stocks in this country was shown in the August report of the Copper Producers' Association. Stocks on hand as of Sept. 1 were 133,441,501 lb., as compared with 137,738,858 lb. as of Aug. 1. Production increased from 112,167,934 lb. in July to 125,493,667 lb. in August. Domestic consumption was 59,935,364 lb. in August, as compared with 56,982,582 lb. in July, and was slightly larger than had been expected. Export deliveries were 69,855,660 lb., as against 74,880,658 lb. in the previous month. There is nothing in the report to indicate improvement in the situation. The excess of consumption over production in July caused substantial reduction in the stocks that were on hand at the beginning of that month, but this encouraging feature was absent in August. Total deliveries last month were 2,072,216 lb. less than in July and production was 13,325,733 lb. larger, so it is evident that the small reduction in surplus stocks in August does not signify marked progress in adjusting the relation between supply and demand. There is no likelihood of an increase in domestic consumption of copper until a decided expansion takes place in general business. In view of the outlook for further dullness in the copper industry in this country, the present decrease in foreign demand shown by the August report is a matter of grave importance. There is a probability that electrolytic will go as low as 12¼ cents cash before consumers will begin to purchase in large amounts. Exports for the present month, including Sept. 12, were 9969 tons. The daily call on the Metal Exchange Sept. 12 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.95	12.05	....
September	11.95	12.05	12.00
October	11.95	12.05	12.00
November	11.95	12.05	12.00
December	11.95	12.05	12.00

The London market, Sept. 12, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	55 5 0	55 3 9
Standard copper, futures	55 18 9	55 17 6

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

Industrial and Commercial Notes

Westinghouse Government Contracts.—A contract has been awarded the Westinghouse Electric & Manufacturing Company by the Bureau of Yards and Docks, Navy Department, for furnishing and installing a complete equipment consisting of motors and control apparatus for two large electrically operated pumps for Dry Dock No. 2 at the United States Navy Yard, Norfolk, Va. There will be two centrifugal pumps, each having a discharge opening of 42 in. in diameter and each driven by a Westinghouse 300-hp induction motor. There will also be one smaller pump having a 15-in. discharge and driven by a 65-hp induction motor, and in addition a small bilge pump with a 3-hp motor. The United States Reclamation Service has recently ordered from the Westinghouse company, for installation on the Boise project, Idaho, three 625-kw, 22,000-volt, three-phase, air-blast-type transformers. Another contract is from the United States Quartermaster's Department, for furnishing the necessary transformers, wattmeters and switchboards for the army post located at Ft. Bliss, Tex., and at the Angel Island Recruit Depot near San Francisco. The post is to have an electric-lighting system installed, energy being purchased from the local electric company. The apparatus is for the purpose of distributing, controlling and measuring the current consumed in the various buildings of these army posts. Recently the company furnished two 75-kw, direct-current, engine-type generators for installation in the McKinley Manual Training School at Washington, D. C., which school is under the direction of the commissioners of the District of Columbia. This order represents an addition to the plant already installed in the school, which consists of a Westinghouse direct-current generator. The Bureau of Insular Affairs has recently awarded a large contract to the same company for electrical equipment to be used by the Porto Rico Irrigation Service at Guayama, P. R. This contract includes a three-phase, 2300-volt, 60-cycle, 700-kw alternator which will be driven by a 1000-hp Pelton water-wheel, and nine transformers with an aggregate capacity of 1500 kw, together with the necessary switchboard and protective apparatus for the 2200-volt transmission line and substation. The present plans include a duplication of this order later on, thus doubling the capacity of the irrigation plant, in the event that the irrigation project proves satisfactory.

German Locomobile Engines.—A large electrical operating company is considering the importation of several German locomobile units, which consist of a boiler and engine combined in one structure. It is stated that the price, with delivery in this country, approaches the cost here of an ordinary boiler and engine of the same capacity. Tests of this type of prime mover have shown an economy as low as 0.783 lb. of coal per brake horse-power, and the makers guarantee a consumption of 1.25 lb. Negotiations are also now pending for the American rights for the manufacture of one of the German types of locomobiles. An output to date of 27,000 locomobiles is claimed by one of the German companies.

Hydroelectric Equipment Wanted for Panama Canal.—The Isthmian Canal Commission invites sealed proposals before Oct. 9 for plant and material for a hydroelectric station at Gatun. Three water turbines of 2250 kw each; three governors, three headgates, three penstocks, three compressed-air regulators, three 2500-kva, three-phase, 220-volt, 25-cycle alternators; two 100-kw motor-driven exciters, three 50-kw exciters, a lubricating system and a 20-ton traveling crane are required. The switchboard, cable control and electric fixtures will be advertised for later. Address inquiries to the commission at Washington for Circular No. 648.

St. Louis Terminal Electric Sign.—The Illinois Traction System, of which H. E. Chubbuck, Peoria, Ill., is general manager, is planning to install a large electric flashing sign above its new St. Louis terminal passenger station. The sign will be about 25 ft. wide by 60 ft. high, with lettering large enough to be read from a distance of six or eight blocks down Twelfth Street, an important St. Louis thoroughfare. The sign will be illuminated by about 2000 5-watt tungsten lamps. It is planned to reproduce on the sign a large interurban passenger car and a block-signal post and blade showing the signal in operation and conveying the impression of a moving car. The sequence of the flash features will be such that the signal blade, approximately 10 ft. long, will "clear"; then a gong or whistle will sound, a large electric head-lamp will flash from the front of the car, the wheels apparently will revolve and the track pass under them to the rear. The sign will cost about $2,500 and will be a permanent advertising feature. It will be operated from dusk until midnight. The sign will be constructed with an angle-iron framework, including 3-in. by 3-in. uprights and 1.5-in. by 1-in. cross-braces. The flasher will be inclosed in a metal house on the roof of the terminal passenger station. The sign, when completed, will be the largest flashing sign in St. Louis.

German Electrical Men Active in China.—Before the ways and means committee of the Chicago Association of Commerce, Hon. William J. Calhoun, American Minister to China, delivered an interesting address on Sept. 6. The following quotation from his speech is of especial interest to electrical men: "The trouble with Americans is that if they can send a bill of goods and draw a draft for it and have it paid, that satisfies them, but they make no effort to cultivate the foreign market. All the other national interests have their people on the ground. Take the Germans, for instance; they are practically monopolizing the electric business and doing a very large business in electrical apparatus, because that is one of the things that the Chinese are taking to. Even cities away in remote districts have electric light plants, and the Germans are on the ground ready to supply all the demands in that line."

Escher-Woiss Turbines.—The Swiss firm of Escher-Woiss & Company has received from the Rio de Janeiro Light & Power Company orders for two 19,000-hp tangential wheels to work under a head of 950 ft. Another recent order received by this company has been from the Tata Hydroelectric Power Company, of Bombay, for four turbines of 13,200 hp and two of 1000 hp, designed for a head of 1680 ft. The Fuji Cotton Mill of Japan has ordered four turbines of 300 hp each, and one of 100 hp for a head of 280 ft. The total capacity of water turbines ordered from the Swiss firm during the month of August aggregated 130,000 hp.

Chinese Electrical Contractors.—A concern known as the Quong On Lung Company has been formed in New York for doing a general electrical contracting business, and has located its offices in close proximity to the Chinese quarter of the city. Representatives of the firm have been working in both New York and Brooklyn and have been instrumental in bringing several new customers to the Edison Electric Illuminating Company of Brooklyn through sales of washing machines they have made to their countrymen.

Allied Machinery Company of America.—Captain G. L. Carden, vice-president and general manager of the Allied Machinery Company of America, is still in Paris arranging for branch offices in a number of European cities. The home office of the company, 55 Wall Street, New York City, has been engaged with the preparation of price lists for use of these foreign agencies. C. N. Thorn, manager of the local office, states that business prospects are encouraging.

Proposed Foreign Tramway and Lighting System.—The *Daily Consular and Trade Reports* states that the representative of a foreign government now in this country has asked it to be announced that a municipality in his country having a population of 100,000 proposes to build an electric-light and street-railway plant. The address of the municipality may be obtained from the Bureau of Manufactures, Washington, by referring to file No. 7303.

Aluminum Notes and Prices.—There has been little change in the aluminum market during the week. Ingots for remelting are quoted at 20 cents to 22 cents spot No. 1 the base for large ingots. Rods and wire are held at 31 cents, and sheets at 33 cents.

Financial.

THE WEEK IN WALL STREET.

RESUMPTION of the irregular trading that was in evidence during the recent decline took place in the closing days of last week, and prices moved downward, accompanied by loss of the cheerful tone that prevailed in the first few days of the month. In the market on Monday of this week many stocks sold at new low levels for the year, but made sufficient recovery late in the day for slight gains to be registered. A feature of the heavy selling was the strength of Canadian Pacific, which led the declining market last week. Conditions on foreign exchanges have improved somewhat, and many issues have recovered from the weakness noted recently abroad. Sales for foreign account were in large volume on Monday, and broadened the scope at the market. Trading on Tuesday showed little improvement, small advances taking place after a day of irregularity. Opening prices were a little higher, on advances of international stocks, but fluctuated until near the close, and then advanced. Although news from abroad on the Moroccan trouble was unfavorable, closing prices on foreign exchanges were steady, and trading was not in accordance with the news. While relations between France and Germany are strained, negotiations are still in progress, and financial circles do not expect a serious outcome. Repetition of the foregoing markets was the case on Wednesday, with a break in early prices and partial recovery at the end of the day. There is a general impression that the declines have been the result of professional operation. Features of interest during the week have been the progress toward settlement of labor troubles on Western roads, reports of railroad earnings, and the possibility of a lower dividend rate on the New Haven road. Shipment of currency to Canada and movement of money abroad have also been incidents of the week. The local money market has been quiet. Rates Sept. 12 were: Call, 2¼@2½ per cent; ninety days, 3¼@3½ per cent. The quotations in the tables are those at the close, Sept. 12.

NEW YORK.

	Sept. 5.	Sept. 12.	Shares Sold.		Sept. 5.	Sept. 12.	Shares Sold.
All. Ch., pf..	18	18*	700	Int. Met., pf.	44⅝	42	7,675
All. Ch.....	6½*	6⅜*	———	Mackay Cos..	83⅛	84*	100
Amal. Cop...	59¼	57	37,675	Mackay C.,pf.	72	72	150
Am. D. T....	20½*	20½*	———	Man. Elev...	135*	135	175
Am. Loco....	35⅝	34½	1,000	Met. St. Ry..	15*	15*	———
Am. Loco.,pf.	105¾	105¾*	300	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	80*	80½*	———	Steel, com...	71¼	63⅛	366,500
Am. T. & T..	135	134¾	6,385	Steel, pfd....	115¾	114¾	7,000
B. R. T.....	76½	73¼	13,000	W. U. T....	75	74	1,500
Gen. Elec...	150¼	150½	2,100	West'h, com..	65½	63⅛	1,400
Int. Met....	15⅜	14⅜	7,000	West'h, pf..	114*	111½*	200

PHILADELPHIA.

	Sept. 5.	Sept. 12.		Sept. 5.	Sept. 12.
Am. Rys.....	44½	44	Phila. R. T.....	22⅝	22¼
El. Co. of A.....	11¾	11⅞	Phila. Elec.....	16⅞	16½
Elec. St. Bt'y.....	53	52	Phila. Trac.....	85	85⅜*
Elec. St. Bt'y., pf..	30*	30*	Union Trac.....	50⅝	50

CHICAGO.

	Sept. 5.	Sept. 12.		Sept. 5.	Sept. 12.
Chi. City Ry.....	186*	186*	Com. Edison.....	133½	135
Chi. Elev. Rys.....	25*	26*	Chi. Subways.....	2¾*	2¾
Chi. Elev. Rys., pf..	90*	89½*	Chi. Tel. Co.....	120½	122*
Chi. Rs., Ser. 1....	95*	92*	Nat'l Car.....	100*	100
Chi. Rs., Ser. 2....	29⅞	29⅞*	Nat'l Car, pf.....	118½*	118½*

BOSTON.

	Sept. 5.	Sept. 12.		Sept. 5.	Sept. 12.
Am. T. & T.....	135¼	134¾	Mex. Tel.....	4¼*	6*
Cum. Tel.....	156*	156*	Mex. Tel., pf.....	6*	6*
Edison Ill.....	284½	280*	N. E. Tel.....	145	145½*
Gen. Elec.....	151	150½	W. T. & T.....	16	17*
Mass. E. Ry.....	18	18¼	W. T. & T., pf.....	98	96½*
Mass. E. Ry., pf....	86½	87½			

*Last price quoted.
Shares sold for the week, Sept. 5 to Sept. 9.

FINANCIAL NOTES.

Traction Merger on Pacific Coast.—The Pacific Electric Railway of Los Angeles has been incorporated at Sacramento with an authorized capital of $100,000,000 to take over a large number of interurban trolley lines controlled by the Southern Pacific Company in southern California. The incorporators of the new company are William F. Herrin and W. C. Martin, of San Francisco; R. C. Gillis and Paul Strong, of Los Angeles, and Epes Randolph, of Tucson, all of whom are Southern Pacific officials. Among the companies that will be included in the merger are the Pacific Electric Railway of

Los Angeles; the Los Angeles Interurban Railway, Riverside & Arlington Railway, of Riverside, Cal.; San Bernardino Valley Traction Company, Redlands Central Railway and the San Bernardino Interurban Railway Company. It is stated that the consolidation was effected in order to place the interurban lines of the Southern Pacific Company in more compact form, with a view to facilitating the present methods of operation. Improvements on a large scale are being planned, including numerous extensions to the lines of the various companies. An expenditure of approximately $30,000,000 will be made for building lines that will double the present mileage, bringing this up to a total of 2000 miles, extending as far north as Santa Barbara and south to San Diego. This expenditure will be made gradually, and no immediate financing is under consideration at present in this connection. It is understood that the stock of the new holding company will be placed in the treasury of the Southern Pacific Company.

American Power & Light Company.—Stockholders of the American Power & Light Company have subscribed to approximately 95 per cent of the $2,200,000 ten-year, 6 per cent gold notes which, as recently described in these columns, were offered to them for subscription on July 5 to the extent of 25 per cent of their stock holdings. The right to subscribe expired at the close of business on Sept. 1. An underwriting syndicate has taken up the amount not subscribed for by stockholders. Inasmuch as many of the stockholders live abroad the extent to which they have responded is unusually gratifying. A feature of the offering is the introduction of the option warrant idea. Each note is accompanied by an option warrant giving the holder the right to subscribe to the company's common stock at par at any time during the next ten years. As the option warrants are detached and transferable, those who subscribed to their allotment of notes have the privilege of holding both the notes and the option warrants or of selling either of these.

Interborough Rapid Transit Company.—The pamphlet report of the Interborough Rapid Transit Company for the year ended June 30, 1911, shows a gross operating revenue of $29,767,352, compared with $28,987,648 in 1910, representing a gain of $779,704. Operating expenses were $12,368,981, an increase of $1,355,839, due, according to President Shonts, to the operation of ten-car express and six-car local trains. Net operating revenue was $17,389,371, as compared with $17,974,505 last year, a decrease of $576,134. Gross income was $15,813,195, as compared with $16,635,107 last year. The surplus over dividends of 9 per cent on the capital stock, as stated by Mr. Shonts, was $1,990,036, a decrease of $942,110, or 32.13 per cent.

Sterling Insulated Wire Company in Receiver's Hands.—On petition of Eastern creditors the Sterling Insulated Wire Company, of 1910 West Kinzie Street, Chicago, was placed in the hands of a receiver on Sept. 8. The liabilities of the company are about $95,000 and the value of the assets available for commercial creditors is about $30,000. E. D. Buell, 53 West Jackson Boulevard, Chicago, was appointed receiver. Samuel Mankowitz was president of the bankrupt company and Jacob Geiserowich was secretary. Aside from a Chicago bank, whose claim is preferred under the present bankruptcy law, the other creditors are mainly manufacturing concerns with headquarters in Eastern States.

Consolidation of Frederick (Md.) Electric Properties.—The Frederick Railroad Company has secured complete control of the Frederick Gas & Electric Company. Announcement has been given that no change will be made in the management of the company. Some time ago the railroad company acquired a controlling interest in the electric company and now has complete ownership of it. The latter is capitalized at $200,000, divided into $100,000 preferred and $100,000 common stock. Both common and preferred stock are divided into shares valued at $25 each. The two companies are under control of home capital.

Kellogg Switchboard Sales.—Business of the Kellogg Switchboard Company in July and August has shown an increase of over 3 per cent as compared with the corresponding months last year. The plants of the company are now working at full capacity, and all departments are employing their full complement of men.

Cuyahoga Telephone Company.—Charles A. Otis, president of the Cuyahoga Telephone Company of Cleveland, Ohio, said in a recent interview that no steps have yet been taken toward the consolidation of the Cuyahoga and Cleveland Telephone companies, and that he thought this would not be undertaken for some time yet. It is the belief of some that several different plans will be submitted to the Ohio Public Service Commission for the consolidation when the time comes, in order that the handling of the matter may be facilitated.

Western Union Telegraph Company.—Present earnings of the Western Union Telegraph Company are showing an increase over the returns for the corresponding period in 1910, and it is believed that earnings for the quarter ending Sept. 30 will be close to 15 per cent in excess of those for the same quarter last year. This would mean net returns of approximately $2,220,000, as compared with $1,941,066 in the quarter last year. Net earnings for the quarter ended June 30, 1911, were $1,982,483.

North American Company.—The Union Electric Light & Power Company, of St. Louis, the Detroit Edison Company and the Milwaukee public utility companies, subsidiaries of the North American Company, are showing an increase of some 12 per cent in the volume of business done. Valuable deposits of gas and coking coal were found recently on coal holdings of the North American Company, in Kentucky, and officials of the company are expecting a substantial increase in revenue from the sale of this product.

Seattle Traction Official Sentenced.—Having violated a ruling of the Washington Public Service Commission prohibiting more than a 5-cent fare without transfer privilege within the corporate limits of Seattle, W. R. Crawford, manager of the Seattle, Renton & Southern Electric Railway Company, has been sentenced to thirty days' imprisonment. Mr. Crawford made an appeal to the Superior Court, and was released on $500 bond.

Louisville Lighting Company.—The municipality of Louisville, represented by Mayor W. O. Head, has indicated that it will not dispose of its stock in the Louisville Gas Company, which owns the Louisville Lighting Company, at 120, the price offered by H. M. Byllesby & Company, of Chicago. It is stated, however, that negotiations for the purchase of the company have been begun by a Philadelphia company.

Bell Telephone Company of Pennsylvania.—A meeting of the stockholders of the Bell Telephone Company of Pennsylvania has been called for Sept. 28 to act upon purchase of the Emporium Telephone Company, a small independent company operating in McKean and Potter Counties, Pennsylvania.

DIVIDENDS.

Buffalo General Electric Company, quarterly, 1½ per cent, payable Sept. 30.

Manila Electric & Lighting Corporation, quarterly, 1¼ per cent, payable Oct. 2.

Northern Ohio Traction Company, quarterly, preferred, 1½ per cent, payable Oct. 1.

Philadelphia Traction Company, semi-anuual, $2 per share, payable Oct. 2.

Tri-City Railway & Light Company, quarterly, preferred, 1½ per cent, payable Oct. 2.

REPORTS OF EARNINGS.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.					
July, 1911	$83,738	$41,121	$42,617	$29,935	$12,682
July, 1910	76,059	39,431	36,628	29,913	6,715
COLUMBUS ELECTRIC COMPANY.					
July, 1911	$39,623	$17,888	$21,735	$14,362	$7,373
July, 1910	38,532	17,917	20,615	17,848	2,767
DALLAS ELECTRIC CORPORATION.					
July, 1911	$125,037	$81,610	$43,427	$25,993	$17,434
July, 1910	117,270	85,473	31,797	26,842	4,955
EL PASO ELECTRIC COMPANY.					
July, 1911	$51,834	$30,777	$21,057	$8,318	$12,739
July, 1910	49,351	29,557	19,794	8,215	11,579
GALVESTON-HOUSTON ELECTRIC COMPANY.					
July, 1911	$136,113	$76,069	$60,044	$25,105	$34,939
July, 1910	122,097	65,989	56,108	26,609	29,499
MINNEAPOLIS GENERAL ELECTRIC COMPANY.					
July, 1911	$106,997	$42,469	$64,528	$39,143	$25,385
July, 1910	88,965	35,854	53,111	30,724	22,387
NORTHERN TEXAS ELECTRIC COMPANY.					
July, 1911	$131,383	$66,878	$64,505	$25,592	$38,913
July, 1910	125,943	68,147	57,796	20,273	37,523
PUGET SOUND ELECTRIC RAILWAY.					
July, 1911	$163,774	$92,833	$70,941	$50,818	$20,123
July, 1910	182,986	102,104	80,782	51,292	29,490
SAVANNAH ELECTRIC COMPANY.					
July, 1911	$64,038	$45,487	$18,556	$18,358	$198
July, 1910	59,140	40,942	18,198	18,193	5
SEATTLE ELECTRIC COMPANY.					
July, 1911	$467,869	$247,595	$220,274	$115,681	$104,593
July, 1910	459,059	261,510	197,549	110,374	87,175
TAMPA ELECTRIC COMPANY.					
July, 1911	$57,252	$29,450	$27,802	$6,929	$20,873
July, 1910	51,506	28,900	22,606	6,711	15,895

General News

Construction News.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has recently placed contracts for one 6250-kva Allis-Chalmers horizontal steam turbine, which will be installed in its main power station, and for jet condensing equipment to be operated in conjunction with the turbine and also with two 3000-kw General Electric turbines. The condensing equipment is manufactured by the Westinghouse Machine Company. Contract has also been awarded to Henry R. Worthington, of New York, N. Y., for three cooling towers, which will be operated in conjunction with the condensing apparatus. The Westinghouse Electric & Manufacturing Company has been awarded contract for one 1000-kw rotary converter to be used for the railway service.

BOAZ, ALA.—The installation of a municipal electric-light plant in Boaz, to cost about $7,500, is reported to be under consideration.

DAUPHIN ISLAND, ALA.—The Dauphin Island Railway & Harbor Company is reported to be contemplating the installation of an electric-light plant. T. W. Nickel, Bank of Mobile Building, Mobile, is chief engineer.

FAYETTEVILLE, ARK.—The Fayetteville Electric Light & Power Company is planning to install a 350-kva Westinghouse turbine Oct. 1 J. W. McLendon is manager.

GRAVETTE, ARK.—The installation of electric-light and water-works systems in Gravette is reported to be under consideration. It is expected that an election will soon be called to vote on the proposition.

LITTLE ROCK, ARK.—The Bankers' Rice Growing Company is reported to be in the market for equipment for an electric generating plant capable of developing 800 hp and also for twelve 60-hp motors. S. C. Dowell, Southern Trust Building, Little Rock, Ark., is president of the company.

COLTON, CAL.—The city of Colton has entered into a contract with the Southern California Edison Company whereby the latter will furnish energy to the city at 1½ cents per kw-hour. The former price was 1¾ cents per kw-hour.

DOWNEY, CAL.—The Downey Light, Power & Water Company has completed its extension to the Norwalk district and is now supplying electrical service in that territory.

ESCALON, CAL.—The Escalon Water & Light Company, recently incorporated, is planning to install an electric-lighting system in Escalon. J. W. Smith, S. T. Irwin and others are interested in the company.

ESCONDIDO, CAL.—The Escondido Mutual Telephone Company, recently organized, is planning to erect a telephone system between Escondido and Oceanside, to connect with the long-distance lines of the Home Telephone Company. The cost of the system is estimated at about $50,000.

FULLERTON, CAL.—An electric power plant will be installed in connection with the group of polytechnic high school buildings to be erected in Fullerton, plans for which are being prepared by Norman F. Marsh, of Los Angeles, Cal., architect.

GLENDALE, CAL.—The city is planning to install an ornamental street-lighting system. Cluster lamps will be used.

INGLEWOOD, CAL.—The Southern California Edison Company is increasing the output of its substation in Inglewood. An arc-lamp street lighting system will be installed.

JAMESTOWN, CAL.—Plans are being considered to equip the Rio Tagus mine, located on Knight's Creek, with electric motors for auxiliary power.

KINGSBURG, CAL.—The city of Kingsburg has awarded the contract for the construction of a new power house to Johnson Brothers.

LOS ANGELES, CAL.—The Board of Public Works has appropriated $1,000 to defray the expenses of Prof. Harris J. Ryan, consulting engineer for the Power Bureau, E. F. Scattergood, chief engineer, and his assistant, T. A. Panter, of the Power Bureau, on a trip of inspection and investigation of hydroelectric developments in the Northwest and East, in connection with preparing plans for the generating equipment on the aqueduct.

LOS ANGELES, CAL.—The Pacific Electric Railway Company, recently incorporated with a capital stock of $100,000,000, has taken over the various interurban electric railways controlled by the Southern Pacific Company in southern California. Among the railways in the merger are the Pacific Electric Railway Company, Los Angeles Pacific Company, Los Angeles & Redondo Railway Company, Los Angeles Interurban Railway Company, Riverside & Arlington Railway Company, San Bernardino Interurban Railway Company. Plans have been approved, it is said, for an expenditure of about $30,000,000 for new construction, the purpose being to increase the total trackage from 1000 miles to 2000 miles. It is understood that no financing is contemplated in the near future. The incorporators are: William F. Herrin, R. C. Gillis, W. C. Martin, Epes Randolph and Paul Shoup.

MONTEREY, CAL.—The Monterey & Pacific Grove Railway Company is planning to extend its railway from Nineteenth Street in Pacific Grove to the Presidio of Monterey.

MOUNTAIN HOUSE, CAL.—Arrangements are being made to equip the machinery at the Omega Mine, near Mountain House, for electrical operation. At present steam power is used.

NEVADA CITY, CAL.—The Pacific Telephone & Telegraph Company is planning to erect a telephone line from Camptonville to Loyalton, a distance of about 80 miles. James Dolan is superintendent of construction in this district.

NEVADA CITY, CAL.—Plans have been approved by the Pacific Gas & Electric Company for the construction of a large dam at Lake Spaulding, which will have a storage capacity of 2,500,000 cu. ft. From this reservoir the water will be conveyed through tunnels and ditches to Bear River. The power plant is to be erected on property formerly owned by the South Yuba Water Company's system, which was absorbed by the Pacific Gas & Electric Company the first of the year. The proposed plants will develop 71,000 hp and will include the erection of a high-tension transmission line from the power plants on Bear River to the Bay centers. The cost of the dam is estimated at $3,000,000 and the entire project will involve an expenditure of about $10,000,000. Rights of way are being obtained for a tower line to tie in with the present system of the company, which covers a large territory in Central California and aggregates in high-tension lines alone about 1100 miles.

OCEANSIDE, CAL.—The Pacific Light & Power Company has commenced work on construction of its dam at the headwaters of the San Luis River, near Oceanside. A hydroelectric plant will be installed later.

OCEANSIDE, CAL.—Plans are being considered by the Young Company for the installation of an ornamental lighting system on the property along the ocean front. J. W. Young, of Long Beach, is interested in the company.

ORO GRANDE, CAL.—The Oro Grande Portland Cement Company, it is reported, is planning to construct an electric railway from Oro Grande and Barstow up the Mojave River valley. Oro Grande has not a post office.

PASADENA, CAL.—The installation of an electrical incinerator at the city sewer farm is under consideration.

PASADENA, CAL.—The installation of an electric power plant, program clocks and intercommunicating telephone system is planned in connection with the new polytechnic high school buildings in Pasadena, About $423,000 is available for the work, plans for which have been completed by Norman F. Marsh, of, Los Angeles, Cal., architect.

RIVERSIDE, CAL.—An agreement has been reached between the City Council and the officials of the Pacific Electric Railway Company whereby a franchise will be granted the company for the construction of an electric railway over the Magnolia extension. The company is completing a railway from Arlington to the county line, which will soon be extended from Locust Street to Fairmount Park. The line will eventually be extended from Riverside to Colton. Paul Shoup is vice-president of the company.

SACRAMENTO, CAL.—It is reported that the City Trustees have adopted a design for electroliers to be erected in the business district of the city under the direction of the Retail Merchants' Association. Specifications for installation of electroliers have been submitted to the City Trustees.

SACRAMENTO, CAL.—The Board of Supervisors has awarded the contract for lighting the streets of Oak Park, Curtis Oaks, Highland Park and East Sacramento districts to the Pacific Gas & Electric Company. Under the terms of the franchise the company is to supply arc lamps at the rate of $6 each per month.

SAN BERNARDINO, CAL.—Negotiations have been closed between Victor Smith, trustee for the Arrowhead Reservoir & Power Company and the Westwater Power & Water Company, of Los Angeles, whereby the Arrowhead Reservoir & Power Company has purchased several thousand acres of land and valuable water rights in the Mojave River from the Westwater Power & Water Company. The Arrowhead Reservoir company is building a large reservoir at the headwaters of the Mojave in Little Bear Valley in the San Bernardino Mountains for the development of a large tract of intermountain arid lands.

SAN DIEGO, CAL.—The Normal Heights Improvement Association is planning to form a lighting district and will apply to the Board of Supervisors to install an electric street-lighting system. The service will probably be supplied by the San Diego Gas & Electric Company, of San Diego, Cal.

SAN FERNANDO, CAL.—H. J. Whitley and O. F. Brant are interested in a project to build an electric railway to connect San Fernando with Los Angeles. The cost of the proposed railway is estimated at about $40,000.

SAN FRANCISCO, CAL.—The State Board of Harbor Commissioners has granted the American-Hawaiian Steamship Company permission to install an electric fire alarm system on its property.

SAN FRANCISCO, CAL.—The Board of Supervisors has voted to appropriate the sum of $7,500 to secure the services of Bion J. Arnold, of Chicago, Ill., to investigate the local street railway situation. There are three entirely independent systems, one being owned by the municipality.

SAN FRANCISCO, CAL.—The properties of the San Francisco & Napa Valley Electric Railroad Company will be sold at public auction on Oct. 30 in San Francisco. The bond issues amount to $1,500,000. The railway is operating from Benicia to St. Helena, via Napa and Napa Valley, a distance of 30 miles.

SAN FRANCISCO, CAL.—The contract for electrical work in connection with the Masonic Temple, located at 101 Post Street, San Francisco, Cal., for the Masonic Temple Association, has been awarded to the General Electric Company, at $7,900. Bliss & Faville, Balboa Building, San Francisco, are architects.

SAN FRANCISCO, CAL.—Application has been made by the West Side Railroad Company for a charter to build an electric railway to connect Sacramento and Rio Vista. The capital stock of the company is placed at $1,000,000. The directors are: William Herlitz, treasurer; B. P. Lilienthal and H. W. Furlong. The headquarters of the company are located at 310 Sansome Street, San Francisco, Cal.

SAN FRANCISCO, CAL.—The large power ditch of the Northern California Company along Battle Creek on the southern border of Shasta County is nearing completion. The ditch is 16 ft. wide at the bottom and 6 ft. deep and 11½ miles long and carries water to the lower power house of the Northern California Company at Coleman, which is the fourth power plant on Battle Creek owned by the company, making a total development of 44,000 hp on Battle Creek. The water is used the first time at Volta, where 9,000 hp is developed, the second time at the South power house and the third time at Inskip.

SAN LUIS OBISPO, CAL.—A franchise has been granted to Walter G. Lincoln to build and operate an electric railway in San Luis Obispo.

SANTA ANA, CAL.—The Pacific Electric Railway Company has been granted permission to equip the tracks of the Southern Pacific Railroad on East Second Street for electrical operation.

SANTA ANA, CAL.—The Board of Trustees has rejected the offer of the Southern California Edison Company to sell its distributing system to the city for $165,000. A new lighting contract will be awarded the company at rates fixed by the board.

STOCKTON, CAL.—The City Council, it is understood, will soon ask for bids for the installation of a conduit street-lighting system, with electroliers, in the business district of the city.

WOODLAND, CAL.—The Vallejo & Northern Railway Company has begun work on the construction of its proposed electric railway from Woodland to Sacramento. The railway will be known as the Sacramento-Woodland Electric Railway.

CANON CITY, COL.—It is reported that H. M. Byllesby & Company, of Chicago, Ill., have secured an option on the entire holdings of the Colorado Light & Power Company, of Canon City. The consideration is said to be between $1,500,000 and $2,000,000. The Colorado Light & Power Company supplies electrical service in the Cripple Creek district and the towns of Canon City, Florence, Concrete, Williamsburg and other places in Fremont County.

BRIDGEPORT, CONN.—The Warner Brothers Company, of Bridgeport, Conn., has just completed a $250,000 power plant. The equipment consists of six boilers, arranged in pairs, four engines, two cross compound and two simple, and four generators.

WALLINGFORD, CONN.—The Board of Electric Commissioners has placed orders for a new 250-hp boiler to be installed in the steam plant of the borough electric system. The cost of the boiler is estimated at about $4,000 and extension to the power plant to make room for boiler will cost about $2,000 more.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company has purchased the franchise granted by the Street and Sewer Department to the Commercial Heat, Light & Power Company in 1907, which gives the company a monopoly of city lighting privileges in this city.

WASHINGTON, D. C.—The Westinghouse Electric & Manufacturing Company has recently furnished two 75-kw direct-current engine-type generators for installation in the McKinley Manual Training School, at Washington, D. C.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Sept. 18 for furnishing underground signal and telephone cable. Specifications and form of proposals may be obtained from the purchasing officer of the District of Columbia.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Sept. 28, for furnishing and installing lighting fixtures in the United States buildings at Columbus, Ind.; Granite City, Ill.; Macon, Mo.; Palestine, Tex.; Santa Cruz, Cal., and Eagle Pass, Tex., in accordance with drawings and specification, copies of which may be obtained at this office. James Knox Taylor is supervising architect.

WASHINGTON, D. C.—The Westinghouse Electric & Manufacturing Company has recently received a contract from the United States Quartermaster's Department, Washington, D. C., for furnishing necessary transformers, wattmeters and switchboards for the army posts located at Ft. Bliss, Tex., and at the Angel Island Recruit Depot, near San Francisco. An electric-lighting system is being installed at Ft. Bliss, energy for which is secured from the local electric-light plant.

BRUNSWICK, GA.—Plans are being considered for the installation of an ornamental street-lighting system on Newcastle Street. The Mutual Light & Water Company, of Brunswick, furnishes the street-lighting service.

CARROLLTON, GA.—The City Council has granted the Georgia Power Company a franchise to supply electricity in Carrollton from its plant at Tallulah or from any other plant which it is developing in the north and western part of Georgia.

JACKSON, GA.—At an election held Sept. 7 the proposition to issue $12,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant and water works system, was carried. The city has decided not to take power from the Central of Georgia Power Company.

BOISE, IDAHO.—Orders have recently been placed by the United States Reclamation Service with the Westinghouse Electric & Manufacturing Company for equipment for the Boise (Idaho) irrigation project, including three 625-kva, 22,000-volt, three-phase, air-blast-type transformers.

WALLACE, IDAHO.—The Burlington Mines Company, it is reported, has commenced work on the erection of a power plant on its property, located near Wallace, Idaho.

EAST MOLINE, ILL.—The contract for the erection of a power house and office building in East Moline has been awarded to A. C. Stouffer. Work will begin as soon as possible on construction of the building, the cost of which is estimated at $7,000. Additional generators and transformers will be installed in the new building.

GREENVILLE, ILL.—The plant and holdings of the Greenville Electric, Gas & Power Company have been purchased by the Hillsboro Electric Light & Power Company, of Hillsboro, Ill. The consideration, it is understood, was $60,000. The Hillsboro company will take over the property Oct. 1. It is stated that the purchase of the property by the Hillsboro Electric Light & Power Company is part of the general plan to build an interurban railway connecting Greenville with Hillsboro and Collinsville. The Hillsboro company now owns and operates twelve electric plants located in Hillsboro, Coffeen, Irving, Witt, Raymond, Harvel, Butler, Nokomis, Taylor Springs and Schram City, Montgomery County; Collinsville and Marysville, Madison County. Negotiations are said to be under way for the purchase of the Troy plant.

LA SALLE, ILL.—The question of installing a new lighting system in La Salle, extending from the Rock Island depot to the Illinois Central station, is reported to be under consideration.

DECATUR, IND.—The Ft. Wayne & Springfield Traction Company will soon place contracts for construction of an extension from Springfield to Portland.

JASPER, IND.—The Board of Trustees has awarded the contract for erection of addition to the power house to A. M. Hochgesang & Sons for $1,979.

MONTICELLO, IND.—Work has been resumed by the Indiana & Northwestern Traction Company in grading and clearing the right-of-way through Newton County for its proposed electric railway, which is to connect Cedar Lake, Reynolds, Hammond, Crown Point, Rensselaer, Lafayette and Chicago.. Subsidies amounting to more than $50,000 have been voted in aid of construction of the railway.

PERU, IND.—The City Council has appropriated $12,000 for erecting ornamental electric lamps around the public square and other improvements.

ALGONA, IA.—It is reported that the City Council has authorized a bond issue, the proceeds to be used for extensions and improvements to the municipal light and water plant.

BOONE, IA.—The Boone Electric Company is installing a new power plant and overhauling its transmission system. The new equipment will include two 1000-kva Allis-Chalmers turbo-generators and a 300-kw motor-generator set to supply power for the railway. The switchboard is of the remote-control type furnished by the General Electric Company. F. W. Laas, of the Cedar Rapids & Iowa City Light & Railway Company, is chief engineer, and J. M. Drabelle, electrical engineer of the same company, is in charge of the erection of the plant.

CLARINDA, IA.—The Lee Electric Light Company has completed a 7-mile transmission line to the town of New Market, Ia., and the street lamps were turned on for the first time Aug. 29. The company has also closed a contract with the Bedford Light, Heat & Power Company whereby it will extend its transmission line from New Market to Bedford, a distance of 15 miles. It is expected to place contracts at once for material for the proposed line, including poles, wire and other material. The present plans call for completion of the line by Dec. 1. Rufus E. Lee is manager of the Lee Electric Light Company.

CORYDON, IA.—Plans are being prepared for the reconstruction of the municipal electric-light system. New equipment will be installed, including engines, generators, boilers, etc. The Iowa Engineering Company, of Clinton, Ia., has charge of the engineering work.

DES MOINES, IA.—The Des Moines River Power Company, it is reported, is contemplating a water-power development on the Des Moin. River about 20 miles below Des Moines. Electricity generated at the plant will be distributed in this city. A. C. Miller, of Des Moines, Ia., is interested in the project.

DES MOINES, IA.—An extension is being built to the power house of the Des Moines City Railway Company to accommodate new equipment purchased recently, consisting of one 300-kw Westinghouse rotary converter, one 500-kw General Electric rotary converter and three 750-kw General Electric transformers. Bids have been asked for coal-handling apparatus and a traveling crane for power station and for a new intake with a well with concrete walls. The necessary switchboards are to be ordered.

ELLIOTT, IA.—The Griswold Electric Light & Power Company of Griswold, Ia., has secured the contract for supplying electricity for lighting the town.

FT. DODGE, IA.—Preparations are being made by the Northern Iowa Power & Light Company, of Humboldt, Ia., for the construction of a large dam and power house across the Des Moines River, at Ft. Dodge, which will involve an expenditure of about $200,000.

HUMBOLDT, IA.—The Northern Iowa Power & Light Company, of Humboldt, Ia., is just completing its second dam across the Des Moines River at Humboldt. The dam and other improvements will represent an expenditure of about $100,000.

IOWA CITY, IA.—The Iowa City & Davenport Railway Company has awarded the contract for construction of an interurban railway, 70 miles in length, to connect Iowa City and Davenport, to C. E. Coon, of Omaha, Neb. The cost of the proposed railway is estimated at about $2,000,000.

IOWA FALLS, IA.—A special election will be held Sept. 25 to vote on the proposition to issue a franchise to construct and operate an electric-light and heating plant in Iowa Falls.

ROLAND, IA.—The contract for the erection of the transmission line from Roland to Story City in connection with the municipal electric-light system has been awarded to C. B. Nelson, of Ames, Ia., at $402.42 per mile, and for wiring the town to C. W. Rowland, of Des Moines, Ia., for $2,896. Electricity for operating the electric-light system will be secured from the municipal electric plant in Story City, Ia.

HILL CITY, KAN.—At an election held recently the proposition to issue $50,000 in bonds for municipal improvements was carried. Of the proceeds $15,000 will be used for the installation of an electric-light plant and $35,000 for water-works system. The J. S. Worley Company, Reliance Building, Kansas City, Mo., is reported to be preparing plans for same.

KANSAS CITY, KAN.—Plans and specifications prepared by the McLaughlin Engineering Company, it is reported, have been approved by the City Commissioners. The city clerk has been authorized to call for bids for construction of the proposed plant immediately. Through oversight this item appeared under Kansas City, Mo., in the issue of Sept. 2.

ALGIERS, LA.—Plans are being considered by Joseph E. Renecky and associates to build an electric railway on Morgan Street and Patterson Street in Algiers.

BALTIMORE, MD.—It is reported that plans have been prepared for lighting the boulevard and University Parkway.

RISING SUN, MD.—Plans are being considered for the installation of an electric-light plant and water-works system in Rising Sun. H. T. Downing, of Wyoming, Del., is engineer in charge.

WILTON, MAINE.—The Board of Selectmen has granted the Wilton Electric Light, Gas & Power Company and the Livermore Falls Electric Light & Power Company permission to erect transmission lines in Wilton. The Wilton Electric Light, Gas & Power Company has sold its charter rights and privileges to the Franklin Electric Light & Power Company, of Farmington, Maine, which gives the latter company the right to extend its transmission lines from Farmington to East Wilton and Wilton villages and furnish electricity for lighting the streets and residences in both villages. Work will begin on the installation of the system at once. The Livermore Falls Electric Light Company was granted permission to erect a system in Wilton.

BEVERLY, MASS.—The Massachusetts Gas and Electric Light Commission has given its approval of the consolidation of the Beverly Gas & Electric Company with the Danvers Gas Light Company. Authority has also been given to issue 1216 shares of additional stock of the Beverly Gas & Electric Company, par value $100, at $170 a share, the proceeds of sixty-nine shares to be used to cancel the 118 outstanding shares of the Danvers company and the remainder to pay for additions to the plant.

BOSTON, MASS.—The Boston Elevated Railway Company has begun work on the construction of six new substations in Brookline, Malden, Arlington, East Boston and Roslindale.

SALEM, MASS.—The Salem Electric Lighting Company is planning to install a 3500-kw turbo-generator set, of the Curtis type, in its power station on Peabody Street. S. Fred Smith is general manager.

SHELBURNE FALLS, MASS.—Plans calling for more extensive works than those previously filed in connection with the Deerfield River development have been recorded in the office of the clerk of courts by Chace & Harriman together with a petition for approval by the County Commissioners. The site of the proposed dam is stated to be about 1000 ft. east of Scott's Bridge on the Deerfield River, near East Charlemont. The dam is to be 45 ft. high and 285 ft. long, of cement construction. The plans also call for the construction of a tunnel 2800 ft. long for the purpose of conveying the waters to a power house to be located in Shelburne Falls.

SWANSEA, MASS.—The Fall River Electric Light Company has applied to the Selectmen for location of its poles in Swansea in connection with the erection of an electric distributing system here.

WILMINGTON, MASS.—A contract has been signed whereby the Reading municipal electric-light plant will supply electricity for street lighting in Wilmington. The contract calls for the installation of 200 lamps, to cost not more than $2,600 per year.

DETROIT, MICH.—The Detroit United Railway Company is reported to be considering the construction of a new crosstown line to extend from the southwestern section of Detroit to the northwestern district and then east to the automobile industry section in the northeastern end of the city.

FREMONT, MICH.—The Board of Trade is considering a proposition to build a municipal hydroelectric power plant on White River, about 12 miles from Fremont. The cost of erecting dam, power house and equipment is estimated at about $38,000; transmission line to Fremont, $12,000, and other expenses $10,000, making the total cost $60,000.

GRAND RAPIDS, MICH.—Chris De Jonge, of Zeeland, and others are reported to be interested in a project to build an electric railway between Grand Rapids and Grand Haven via Georgetown, Blendon and Robinson.

PORT HURON, MICH.—The property of the Port Huron Light & Power Company has been taken over by James T. Lynn and associates. Mr. Lynn already owns the Port Huron Gas Company. The officers of the new company are: James T. Lynn, of Detroit, Mich., president; P. H. Phillips, of Port Huron, Mich., vice-president; V. N. Gurney, of Detroit, Mich., secretary, and J. G. Sloan, of Port Huron, Mich., manager.

FRANKLIN, MINN.—Plans are being considered by the Wherland Electric Company, of Redwood Falls, Minn., to extend its transmission lines to Franklin to supply electricity for lighting this village.

ST. PAUL, MINN.—Bids for lighting the streets of the city for the two ensuing years beginning Jan. 1, 1912, have been submitted to the Assembly by the St. Paul Gas Light Company and the Patterson Street Lighting Company. The St. Paul Gas Light Company submitted a proposal providing for the use of its present arc-lamp equipment, although the specifications did not contemplate a bid on the equipment now in use. The company offered to furnish the service with the present equipmen at the rate of $66 per lamp per year and would represent a saving of about $9,000 as compared with the present contract. The present price is $75 each per year for arc lamps with overhead service and $90 per lamp with underground service. On the combination of the present arc lamps and the new flaming arc lamps for the year 1912 the company submitted the following proposals: Inclosed-arc lamps, $69 each; flaming-arc lamps with overhead and underground service, $90 each. For 1913, inclosed-arc lamps, $67.50; for flaming-arc lamps with overhead and underground service, $90 each. It is estimated that the first year of the contract 680 of the present arc lamps would be used and 250 of the flaming arc lamps would be in service. On the ornamental lamps the company submitted a proposal of $75 a standard per year, a reduction of $5 per year from the present price. The company submitted a bid for gas lamps offering to supply the service at the same price as last year, $13 a post; for bridge lamps $2 per lamp per month. The Patterson Street Lighting Comany offered to maintain the gas lamps at $10 per lamp per year, which is a reduction of 50 cents per lamp on the present contract. The Council will soon consider bids for furnishing lamp equipment such as is now used by the Patterson company. The city has appropriated $75,000 to purchase such equipment and may do so if the bids are satisfactory.

ST. PETER, MINN.—The Consumers' Power Company is reported to have submitted a proposition to the City Council offering to supply electricity in St. Peter.

THIEF RIVER FALLS, MINN.—Plans are being prepared for the construction of an auxiliary steam-power plant in Thief River, for which bonds to the amount of $40,000 were recently sold. Bids for construction of the proposed plant will be received until Sept. 19. Erick Wolf, of Minneapolis, Minn., is engineer in charge.

HOLDEN, MO.—The question of installing an electric-light system in Holden is under consideration.

LAMAR, MO.—It is reported that additions and improvements are contemplated to the electric-light plant and water-works system involving an expenditure of about $70,000, plans for which are being prepared by Rollins & Westover, Beals Building, Kansas City, Mo.

ST. LOUIS, MO.—The Board of Public Improvements is making arrangements to connect the new city hall power plant with other municipal buildings. Bids have already been asked for furnishing and installing conduit and cables. Maxime Reber is president of the board.

ST. LOUIS, MO.—Plans are being considered by the Illinois Trac-

tion System for the erection of a large electric flashing sign to be erected above its new St. Louis terminal passenger station. The sign will be 25 ft. x 60 ft. and will be illuminated by 2000 5-watt tungsten lamps and will be operated from dusk until midnight. It is proposed to reproduce on the sign a large interurban passenger car and a block-signal post and blade showing the signal in operation and conveying the impression of a moving car. The cost of the sign is estimated at $2,500. H. E. Chubbuck, of Peoria, Ill., is general manager.

TWIN BRIDGES, MONT.—It is reported that surveys are being made by the Madison River Power Company for the erection of a transmission line from Ruby for the purpose of supplying electricity for lamps in the towns of Laurin, Sheridan and Twin Bridges.

FAIRBURY, NEB.—The installation of an ornamental street-lighting system in Fairbury is reported to be under consideration.

PLATTSMOUTH, NEB.—The question of installing a municipal electric-light plant and water works plant in Plattsmouth is reported to be under consideration.

BLACKHORSE, NEV.—A hydroelectric plant is being built on Leahman's Creek by the Amalgamated Nevada Mining Company. A distributing system will be erected to serve the mining properties in the eastern part of White Pine County.

ELY, NEV.—The Telluride Power Company, of Telluride, Col., is planning to erect a hydroelectric near Ely and to erect a transmission line to Richfield, Utah, via Pioche, Nev., and from that point to Eureka, Utah, where it will connect with the company's system there.

JARBRIDGE, NEV.—Plans are being prepared by the Crater City Company for the construction of a power plant on Three Creeks, near Jarbridge.

GARFIELD, N. J.—The Council is considering the question of installing a municipal electric-light plant, plans for which have been prepared by Daniel R. Bacon, of New York, N. Y., to cost approximately $45,000.

MILLVILLE, N. J.—The installation of municipal electric-light and water plants in Millville is reported to be under consideration.

GALLUP, N. M.—An agreement has been made whereby the various suits between the town of Gallup and the county of McKinley and the Gallup Electric Light & Power Company have been settled. The town of Gallup agrees to drop its attack on the company's franchises and rights. Negotiations are under way between the town and the company for closing a new contract for street lighting.

BINGHAMTON, N. Y.—The contract for the construction of a general power house and installation of a heating plant at the Susquehanna Valley Home has been awarded to the C. W. Mitchell Company at $4,573.

CATSKILL, N. Y.—Owing to the village authorities and the officials of the Schoharie Light & Power Company being unable to reach an agreement the municipal authorities have petitioned the Public Service Commission, Second District, to fix a price to be paid for the street-lighting service in this village under a new contract.

EPHRATAH, N. Y.—The Mohawk Hydroelectric Company has applied to the Public Service Commission, Second District, for permission to erect transmission lines in Ephratah, Palatine and Nelliston, and also for authority to issue $56,000 in bonds.

FT. PLAIN, N. Y.—The Ft. Plain Gas & Electric Light, Heat & Power Company has applied to the Public Service Commission, Second District, for permission to lease its electrical distributing system in the village of Nelliston to the Mohawk Hydroelectric Company.

NEW YORK, N. Y.—The Long Acre Electric Light & Power Company has executed a general mortgage to the Empire Trust Company covering all its property in Manhattan and the Bronx for $50,000,000. The company has received authority to issue stock and bonds to the amount of $50,000,000.

ONEIDA, N. Y.—The installation of an ornamental lighting system in Oneida is under consideration. The lighting contract expires Jan. 1, and it is proposed to have provision made in the new contract for ornamental lamp standards.

RICHFIELD SPRINGS, N. Y.—The Richfield Springs Electric Light & Power Company has petitioned the Public Service Commission, Second District, for permission to assign its franchise in Richfield Springs to the Richfield Springs Utility Company. The latter company has applied to the commission for the right to acquire this franchise and for authority to issue $47,000 in bonds.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has submitted a scheme to the East Avenue residents' committee for ornamental street lighting on East Avenue. The designs call for ornamental concrete poles, equipped witth double arms, each carrying a high power Mazda lamp.

YAPHANK, N. Y.—Bids will be received by the Board of Supervisors, Court House, Riverhead, N. Y., until Sept. 20 for furnishing material and installing electric wiring and fixtures in County Almshouse and Children's Home, at Yaphank. Information and specifications may be obtained from Myron E. Overton, clerk of Board of Supervisors, Riverhead, N. Y.

RALEIGH, N. C.—The Board of Aldermen is considering the question of placing cluster lamps on West Martin Street and Fayettevillle Street.

FT. RANSOM, N. D.—The construction of an electric railway between Enderlin and Ft. Ransom is under consideration. E. S. Lovelace, G. Jacobson and O. A. Culbertson, of Ft. Ransom, are interested in the project.

GRAFTON, N. D.—Sealed bids will be received by the Village Board of Grafton, N. D., until Sept. 22 for constructing and installing an electric-light plant and water-works system in Grafton. Plans and specifications are on file at the office of the village clerk, and the office of Elmer L. Jensen, engineer, Harvard, N. D. The cost of the work is estimated at $12,500.

DEFIANCE, OHIO.—The Ohio Electric Railway Company, of Cincinnati, Ohio, is contemplating extending its Defiance & Lima branch into Defiance. The present terminus is in the suburbs and it is proposed to extend the line as far as the Auglaize River bridge.

HIRAM, OHIO.—E. H. Rankin, of Cleveland, Ohio, has purchased the local electric-light plant and is planning to remodel and rebuild the same.

MEDINA, OHIO.—The Council on Aug. 22 granted E. H. Rankin, of Cleveland, a franchise to install an electric-light system in Medina. Mr. Rankin is planning to erect a plant here, using alternating current with gas engine power.

COLLINSVILLE, OKLA.—At an election held recently the proposition to issue bonds to the amount of $45,000, the proceeds to be used for the construction of a municipal electric-light and power plant, was carried.

PAWHUSKA, OKLA.—It is reported that plans are being prepared for extensions and improvements to the municipal electric-light plant to cost $10,000 and for additions to the water-works system to cost about $50,000. Albert York is city clerk.

FT. STEVENS, ORE.—Sealed proposals will be received at the office of Post Quartermaster, Ft. Stevens, Ore., until Oct. 3 for installation of hot-water heating, including construction of basement and electric lighting in same, in Barracks Nos. 20 and 22 at Ft. Stevens, plans and specifications for which may be seen at the above office.

LAKEVIEW, ORE.—The Nevada, California & Oregon Telephone & Telegraph Company has awarded a contract to C. H. Lee for the extension of its lines to Lakeview.

MYRTLE CREEK, ORE.—The Council is reported to have voted in favor of establishing water and lighting systems in Myrtle Creek.

ONTARIO, ORE.—The contract for supplying electricity to operate the pumping plants for the Ontario-Nyssa irrigation project has been awarded to the Idaho-Oregon Light & Power Company. The contract calls for 25 hp for the season with a twenty-four service, the electric company to furnish the transformer. The company also agrees to erect an electric transmission line along the ditch to accommodate owners of individual pumping plants who wish to raise the water above main ditch for irrigation purposes and will build such a line, one mile for every 10 hp contracted for.

VALE, ORE.—Investigations are being made by the Telluride Power Association, of Salt Lake City, Utah, with a view of extending its transmission lines in Eastern Oregon. The company purchased the local electric plant several months ago in order to secure a foothold in this section. A transmission line is now being erected from the company's new plant near Bliss, Idaho, to this city, a distance of over 200 miles. L. L. Nunn, of Salt Lake City, Utah, is general manager of the company.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until Oct. 6, for reinforcing grids and vault lamps. Blanks and general information in relation to this circular (No. 647-A) may be obtained from the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 615 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco Cal. Major F. C. Boggs is general purchasing officer.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until Oct. 9, for plant and materials for hydroelectric station at Gatun, including water turbines, governors, head gates, penstocks, compressed-air regulators, electric generators, exciters, exciter sets, lubricating system, traveling cranes, etc. Blanks and general information relating to this circular (No. 648) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Whitney-Central Building, New Orleans, La., and 1086 Point Street, San Francisco, Cal.; also at the United States engineer offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Chamber of Commerce and Board of Trade, Tacoma, Wash. Major F. C. Boggs is general purchasing officer.

BLOOMSBURG, PA.—The Bloomsburg & Millville Street Railway Company has been reorganized and plans have been made to complete the railway. The new company will be known as the Bloomsburg, Millville & Northern Railway Company.

HARRISBURG, PA.—Application will be filed with Governor Tener for a charter for the Brecknock Township Electric Company by J. Milton Miller and Richmond L. Jones. The company proposes to supply elec-

tricity for light, heat and motors in Brecknock. Application will also be made for a charter for the Adamstown Electric Company, which proposes to supply electrical service in Adamstown. The companies will be subsidiaries of the Metropolitan Electric Company.

LEBANON, PA.—The contract for the construction of the Lebanon & Campbelltown Street Railway has been awarded to C. J. Barr and William S. Davis, of Lebanon, and M. E. Brightville, of Annville. The proposed railway will be about 9 miles in length. M. S. Hershey is president.

MILLERSVILLE, PA.—The Lancaster & York Furnace Street Railway Company is planning to install a turbine or 500-kw, three-phase, 25-cycle, direct-connected unit in its power plant at Millersville, orders for which will be placed in the near future. E. W. Goss is general manager.

NEQUEHONING, PA.—The citizens are considering the question of lighting the streets of the town with electricity. It is understood that the Lehigh Coal & Navigation Company has submitted a proposition to furnish the service at a reasonable rate. B. Snyder, Jr., is manager of the Lehigh Coal & Navigation Company.

NEW BRIGHTON, PA.—The Beaver Valley Traction Company expects to purchase a 150-cu. ft. air compressor and two turbines for its power plant.

NEW CASTLE, PA.—The Lawrence Hydro-Electric Company has made application for a charter for the purpose of erecting a hydro-electric plant on the banks of Slipperyrock creek, near McConnell's mills. The incorporators are: F. M. Butler, F. G. Ross and C. F. Young.

PHILADELPHIA, PA.—The contract for the construction of the large power house for the Philadelphia & Reading Railway Company, at St. Claire, Pa., has been awarded to Irvin & Leighton, of Philadelphia, Pa. L. F. Shoemaker & Company, of Philadelphia, Pa., have been awarded the contract to build an 85-ft. turntable at the new round house of the company at St. Clair, which will be operated by an electric motor, electricity for which will be supplied by the new power house.

SNOW SHOE, PA.—The Snow Shoe Electric & Street Railway Company has applied for a charter to build an electric railway, 2 miles in length, to connect Snow Shoe and Bellefontaine. The capital stock of the company is placed at $15,000. The incorporators are: David Chambers, John G. Uzzle, James Uzzle, George B. Uzzle and W. E. Brown.

GUAYAMA, P. R.—The Bureau of Insular Affairs has recently awarded a contract to the Westinghouse Electric & Manufacturing Company for electrical equipment to be used by the Porto Rico Irrigation Service at Guayama, P. R., consisting of one 700-kva, three-phase, 2300-volt, 60-cycle alternator, which will be driven by a 1000-hp Pelton waterwheel; nine transformers with an aggregate capacity of 1500 kva and necessary switchboard and protective apparatus for the 2200-volt transmission line and substation. The present plans include a duplication of this order later on.

DILLON, S. C.—The city has voted to issue $70,000 in bonds, of which the proceeds of $3,000 will be used for additions to the municipal electric-light plant.

LAURENS, S. C.—The Reedy River Power Company is reported to have purchased mill property and 73 acres of land at Tumbling Shoals, on Reedy River, 13 miles west of Laurens. It is understoood that the company will develop the water-power to supplement power generated at its present Reedy River plant, located 5 miles below this point on the Reedy River.

SIOUX FALLS, S. D.—It is reported that H. M. Byllesby & Company (owners of the Sioux Falls Light & Power Company) will extend the electric transmission lines to the McKennan Hospital.

JONESBORO, TENN.—At an election held recently in Jonesboro the citizens voted to issue $25,000 in bonds to aid in building an electric railway from Jonesboro to Johnson City, a distance of about 8 miles. The cost of the proposed railway is estimated at about $40,000.

AUSTIN, TEX.—At an election held recently the citizens voted to ratify the contract with William D. Johnson, of Hartford, Conn., to build a dam across the Colorado River in Austin. The cost of the dam including power house is $1,600,000, to be paid in twenty-five instalments.

DECATUR, TEX.—The electric-light plant and water works system of the Decatur Light & Water Company, was destroyed by fire on Sept. 2.

HOUSTON, TEX.—The Greater Houston Suburban Corporation is reported to have awarded a contract to the J. M. Winfrey Engineering Company, of Houston, Tex., to install an electric-light plant.

PITTSBURG, TEX.—The City Council has granted F. E. Prince, owner of the Pittsburg and Longview box factories, a fifty-year electric-light franchise and a contract for lighting the streets of the city. Work will begin at once on construction of the new electric-light plant.

SAN ANTONIO, TEX.—The San Antonio Traction Company is remodeling and making improvements to its power plant in San Antonio.

STOCKDALE, TEX.—The Stockdale Cottonseed Oil Mill Company, it is reported, is contemplating the installation of an electric-light plant.

TROUP, TEX.—The Troup Gin, Mill & Light Company, which has recently built a cotton mill in Troup, is reported to have taken over the local electric-light plant.

NORFOLK, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has recently awarded the Westinghouse Electric & Manufacturing Company a contract for furnishing and installing complete electric equipment consisting of motors and control apparatus for two large electrically operated pumps, for Dry Dock No. 2, at the United States Navy Yard, Norfolk, Va. There will be two centrifugal pumps, each having a discharge opening of 42 in. in diameter, and each driven by a Westinghouse 300-hp type HF induction motor. A smaller pump will also be installed, driven by a 65-hp type CCL induction motor and a small bilge pump with a 3-hp motor. The pumps are being built by R. D. Wood Company, of Philadelphia, Pa.

ELLENSBURG, WASH.—The city is reported to have voted to issue $110,000 in bonds for improvements to the municipal electric-light plant and bonds to the amount of $100,000 for construction of water works system.

LOON LAKE, WASH.—A proposition has been submitted to Gerhke & Sons, proprietors of the planing mill, to finance the installation of an electric light plant in connection with their mill.

TACOMA, WASH.—The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., has secured the contract for entire switchboard and auxiliary apparatus for power house, substations and transmission line of the hydroelectric power plant on the Nisqually River being erected by the city of Tacoma. The amount involved in the contract is about $85,000.

WASHOUGAL, WASH.—Application, it is reported, has been made by Samuel Sampson for a franchise to erect a high-tension transmission line through Washougal on to Vancouver, a distance of 60 miles.

MASONTOWN, W. VA.—H. C. Greer, president of the Preston County Coke Company, of Cascade, Va., is reported to have been granted a franchise to install a street-lighting system and to supply electricity generated at the company's plant at Cascade in Masontown.

SISTERVILLE, W. VA.—The Sisterville Electric Light & Power Company has placed an order with the Mesta Machine Company, of Pittsburgh, Pa., for one 20-in. by 24-in. twin-tandem, horizontal, double-acting, four-cycle gas engine. The engine will operate with natural gas and is rated at 1000 hp, being arranged for direct connection to a 650-kw, 60-cycle, 2300-volt generator.

APPLETON, WIS.—Plans are being considered by the Wisconsin Traction, Light, Heat & Power Company for the construction of a new plant at the Gardner dam, near Antigo. Electricity generated at the plant will be transmitted to Appleton.

EAU CLAIRE, WIS.—Changes are being made in the transmission line of the Chippewa Valley Railway, Light & Power Company connecting with Red Wing, which will increase the voltage from 33,000 to 66,000. The line is being extended from Red Wing to Lake City.

MAZOMANIE, WIS.—It is reported that the contract for the installation of an electric-light plant in Mazomanie has been awarded to the Ft. Wayne Electric Works, Ft. Wayne, Ind., for $4,715.

MELLEN, WIS.—Work has begun on the construction of a power plant in Mellen for the Ashland Light, Power & Street Railway Company, which is to supply power to the plants at White River, Ironwood, Ashland, Bessemer and Hurley.

PLYMOUTH, WIS.—The Water and Light Commission has decided to engage Thomas S. Watson, of Milwaukee, Wis., consulting engineer, to prepare plans and specifications for a new municipal electric-light plant in Plymouth.

PRINCE RUPERT, B. C., CAN.—At an election held Sept. 6 the by-law appropriating $550,000 for an electric-light plant and water-works system in Prince Rupert was carried.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company, Ltd., has awarded the contract for extension of its auxiliary steam-power plant to C. C. Moore & Company, of Seattle, Wash. The equipment will include four Babcock & Wilcox boilers, of 500 hp each, one 200-kw Allis-Chalmers turbo-generator, condensers, piping, etc. The output of the plant will be increased to 12,000 hp. The cost of the work is estimated at about $250,000.

TORONTO, ONT., CAN.—The city of Toronto has filed plans for the erection of steel towers to carry a 13,200-volt transmission line across the eastern, the old western and the new channels entering Toronto Harbor with the Department of Public Works at Ottawa, Ont.

SASKATOON, SASK., CAN.—By-laws appropriating $863,000 for various civic improvements, including a new electric-light and power plant, a large intercepting sewer and disposal plant, a water-filtration plant and several other projects, have been passed by the Council.

OAXACA, MEX.—Lic. Jose Vasconcelos, of Mexico City, is reported to have applied for a concession to erect an electric light and power system in this state. It is proposed to supply electricity for lamps and motors to towns and mining properties in this district.

New Industrial Companies.

THE CONSOLIDATED ENGINEERING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $50,000. The incorporators are: Albert F. Polk, of Georgetown, Del.; F. Marion Hall, Edwin W. Wells and Charles A. Cummins, all of Baltimore, Md.

THE CRONK-SALTER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by H. Taylor Cronk, 25 West Eleventh Street; A. Plafford Cronk, 25 West Eleventh Street, and Jasper C. Salter, of 26 Broadway, all of New York, N. Y. The company proposes to acquire and develop patents.

THE ELECTRICAL SHOW ASSOCIATION OF UTAH, of Salt Lake City, Utah, has filed articles of incorporation with a capital stock of $5,000. The company proposes to engage in electrical shows, general entertainment business, general electrical business, to deal in electrical supplies and to engage in the handling of electrical signs, etc. The officers are: B. W. Mendenhall, president; C. B. Hawley, vice-president; R. J. Dinwoody, secretary, and William Kennedy, treasurer.

THE FURST CONCRETE SCOW CONSTRUCTION COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $100,000. The company proposes to carry on a reenforced construction business and to manufacture telegraph poles and other articles; also the construction of scows, barges and other vessels. The officers are: Frank A. Furst, president; Michael T. Homer, vice president, and Joseph J. Hock, secretary and manager.

THE MIDLAND ELECTRICAL & MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated by Andrew Engstrom, Arthur O. Carlson and Frederick Deiser. The company is capitalized at $50,000 and proposes to manufacture mechanical devices.

THE NEW PROCESS LIGHTING & HEATING COMPANY, of La Porte, Ind., has filed articles of incorporation with a capital stock of $50,000. The company proposes to manufacture a new heating and lighting device.

THE NORTHOLL ENGINEERING & CONSTRUCTION COMPANY, of Vancouver, B. C., Can., has filed articles of incorporation with a capital stock of $100,000.

THE OVERLAND ROCHESTER COMPANY, of Rochester, N. Y., has been granted a charter with a capital stock of $30,000 to manufacture motors, engines, etc. The incorporators are: Edward D. Creed, 121 East Avenue, Rochester, N. Y.; Royal R. Scott, of Canandaigua, N. Y., and Clifford F. Cribb, 228 Field Street, Rochester, N. Y.

THE PAIGE ELECTRIC SIGN COMPANY, of Worcester, Mass., has been incorporated with a capital stock of $15,000 by Lucius R. Paige, Michael J. Kane and George R. Stubb.

THE PETROLEO COMPANY, of New York, N. Y., has been incorporated with a capital stock of $25,000 by C. D. Morton, 50 Church Street; H. J. Brewer, 50 Church Street, and William H. Davis, 70 Broad Street, all of New York, N. Y. The company proposes to manufacture oil engines, machinery, etc.

THE PRECISION STEEL BALL COMPANY, of Syracuse, N. Y., has been incorporated by Alexander T. Brown, Willard C. Lipe and William C. Sharrer, all of Syracuse, N. Y. The company is capitalized at $100,000 and proposes to manufacture balls, bearings, etc.

THE RIDGEFIELD ENGINEERING WORKS, of Ridgefield Park, N. J., has filed articles of incorporation with a capital stock of $125,000 for the purpose of manufacturing engines, motors, machinery, etc. The incorporators are: Robert Burns, Jr., of Ridgefield Park, N. J.; Samuel J. Katzberg and Daniel W. Steele, Jr., both of 170 Broadway, New York, N. Y.

THE WESTINGHOUSE GEAR & DYNAMOMETER COMPANY, of Pittsburgh, Pa., has been granted a charter with a capital of $5,000. The directors are: Miles H. England, 249 Forty-third Street, Pittsburgh, Pa.; Alexander Black, and Walter E. Galbreath, of Pittsburgh, Pa.

New Incorporations.

LITTLE ROCK, ARK.—The Stuttgart & Southern Railway Company has been incorporated with a capital stock of $300,000 to build an electric railway from Stuttgart through Arkansas County to a point on Bayou Meto, a distance of 25 miles. The incorporators are: J. I. Porter, John L. Ingram, Phillip Reinsch, Elliott Tallman, J. W. Underwood, L. E. Morphew and George C. Lewis.

SAN FRANCISCO, CAL.—The Placer Electric Power Company has been incorporated with a capital stock of $2,000,000 by R. H. Borland, F. W. Nightingill, R. T. Harding, N. C. Butler and I. Lindemann.

SAN FRANCISCO, CAL.—The West Sacramento Electric Company has been granted a charter with a capital stock of $100,000. The incorporators are: B. P. Lilienthal, H. W. Furlong, W. Herlitz, T. T. C. Gregory and C. J. Goodell.

SAN JOSE, CAL.—The San Jose Terminal Railway Company has been incorporated with a capital stock of $2,500,000 by H. H. McCloskey, John A. Mehling and Hugh Center. The company proposes to construct an electric railway from San Jose to Alviso, a distance of about 8 miles.

BRIDGEPORT, CONN.—The Shelton & Bridgeport Traction Company has been incorporated by O. G. Beard, Jr., L. E. Moulthrop and B. N. Beard. The company proposes to build an electric railway to connect Shelton, Huntington Centre, Trumbull and Bridgeport.

WAYCROSS, GA.—The Waycross Street & Suburban Railway Company has been granted a charter with a capital stock of $150,000. The company proposes to build an electric railway, 30 miles in length, to connect Hebardville, Deenwood, Winona Park, Blackshear, Waresboro and Waycross. The incorporators are: L. J. Cooper, George W. Dean, A. M. Knight and J. M. Cox, all of Waycross.

BEECHER, ILL.—The Beecher Electric Light & Power Company has been granted a charter with a capital stock of $6,000. The officers are: Herman Ruge, president; Thomas Clark, vice-president; William J. Henze, secretary and George Batterman, treasurer.

CHICAGO, ILL.—Articles of incorporation have been filed for the Chicago Suburban Traction Company with a capital stock of $25,000 by Louis J. Behin, H. Morton Taylor and Frank R. Utely. The company proposes to build an interurban railway from Chicago.

CHICAGO, ILL.—Articles of incorporation have been filed for the Public Service Company of Northern Illinois with a capital stock of $1,000 by Harry J. Danbaugh, Cyrus H. Adams, Jr., and George C. Madison. The company proposes to operate a heat, light and power plant.

HENRY, ILL.—The Kewanee, Bradford & Henry Interurban Railway Company has been incorporated with a capital stock of $5,000 to build an electric railway to connect Bradford, Henry and Kewanee. The incorporators are: John P. Code, of Bradford; John P. Brady, of Kewanee; Howard G. Stoner, of Henry; William H. Haines and Daniel J. Phenil, of Peoria.

QUINCY, ILL.—The Quincy & Western Illinois Electric Railway Company has been incorporated with a capital stock of $5,000 by W. T. Duker, H. F. Dayton, J. P. Wall, William S. Govert and S. B. Montgomery, all of Quincy. The company proposes to build an electric railway from Niota to Quincy, a distance of 75 miles.

EVANSVILLE, IND.—The People's Telephone Company has been incorporated with a capital stock of $10,000 to build and operate a telephone system in the counties of Vanderburg, Pasey and Gibson. The incorporators are J. M. Lewis, William R. Hoods, G. L. Pierce.

OFFERLE, KAN.—Articles of incorporation have been filed for the Peoples Co-operative Telephone Company with a capital stock of $10,000.

HICKMAN, KY.—The Southwestern Kentucky Electric Railway, Light & Power Company has filed articles of incorporation under the laws of the State of Delaware to build an electric railway from Paducah to Hickman, Ky., via Mayfield, Fulton and Union City, Tenn., or from Paducah through the north of Ballard County, following the Mississippi River. The officers are: H. C. Rhodes, of Paducah, president; John D. Smith, secretary and R. H. Scott, treasurer.

MELDER, LA.—The Melder-Forest Hill Telephone Company has been incorporated with a capital stock of $10,000.

PHILLIPS, MAINE.—The Phillips Electric Light & Power Company has been incorporated with a capital stock of $10,000 by Herbert H. Berry, of Yarmouth, Maine; Newell P. Noble, of Phillips, Maine, and Elliott C. Dill, of Hallowell, Maine.

FORMAN, N D.—The Forman, Rutland & Havana Telephone Company has been chartered with a capital stock of $10,000 by John Powers, of Havana; A. E. Land and H. O. Gardner, both of Forman, N. D.

Personal.

MR. J. C. LAWLER has been appointed manager of the Walsenburg Light, Power & Ice Company, Walsenburg, Col.

MR. SETH H. DYER has been appointed electrical engineer of the Hidalgo Cement Works, Matehuala, San Luis Potosi, Mexico.

MR. M. C. MILLER, assistant to President Call of the Allis-Chalmers Company, has been given general oversight of the publicity work of that company.

MR. E. F. BAKER, general manager of the hydroelectric plant at York Haven, has resigned his position and will be succeeded for the present by Assistant Manager W. J. Hunker.

MR. CHARLES H. CLARE, formerly chief engineer of the Storage Battery Lighting Company, Chicago, has joined the staff of the Triumph Electric Company and will be attached to its New York office in the capacity of sales engineer.

MR. F. W. WEBSTER, manager of the Fresno and Stockton (Cal.) electric railways, of the Southern Pacific Railroad Company, has been appointed manager of the Visalia electric railway, Visalia, Cal., in addition to his present duties.

MR. H. H. HIGBIE, until recently of the electrical engineering department of the University of Michigan, has joined the faculty of Wentworth Institute, a new trade school in Boston, a part of the work of which will be to give training in electrical work.

MR. J. W. GARDNER, manager of the power and electrical department of the Allis-Chalmers Company at West Allis, Wis., was formerly district manager for that company in Chicago. Mr, Gardner's engineering training stands him in good stead in the management of an important department in the home office.

MR. M. H. GREGG has been appointed manager of the Central Oakland Light & Power Company, of Oakland, Cal. Mr. Gregg is a graduate of the engineering department of the University of Michigan, and for the last five years has been connected with the power contract department of the Southern California Edison Company, Los Angeles, Cal.

MR. FREDERICK VON SCHLEGELL is now district manager in Chicago for the Allis-Chalmers Company, his territory embracing Chicago and St. Louis. Mr. von Schlegell has been connected with the Chicago office of the company for several years and before that was employed in the railroad and gas-engine department of Fairbanks, Morse & Company.

MR. W. E. PLAYTER, who has been with the Mayfield Water & Light Company for more than ten years as resident engineer and has had charge of several engineering propositions in the South while with this company, has resigned and will on Oct. 1 enter the service of the St. Louis Smelting & Refining Company as engineer of the Collinsville Works, at Collinsville, Ill.

MR. ALLAN B. FIELD, prominently connected with the engineering department of the Westinghouse Electric & Manufacturing Company, sailed from New York Sept. 9 on the *Minnetonka* for an extended business and pleasure trip to Europe, accompanied by his bride. His marriage to Miss Virginia W. Pearne of Cincinnati, took place at Ocean Grove, N. J., on Sept. 8.

MR. HARRY B. KIRKLAND, vice-president of the American Conduit Manufacturing Company, Pittsburgh, Pa., was married Sept. 14 to Miss Emily Roberts Houghton, daughter of Dr. and Mrs. Owen E. Houghton, Brooklyn, N. Y. The ceremony took place at the home of the bride's sister, Mrs. Girard B. Townsend, Montclair, N. J. After a wedding trip of several weeks, the happy couple will make their home in Pittsburgh.

MR. WILLIAM J. HAGENAH, formerly chief statistician of the Wisconsin Railroad Commission, has opened an office in the First National Bank Building, Chicago, as a public-utility statistician. Mr. Hagenah was retained by the city of Chicago in recent investigations into telephone rates and gas rates, and is now making a report on rates and service for the Union Electric Light & Power Company, of St. Louis, and is also investigating the gas situation in Des Moines for the local company.

MR. CHARLES H. JUMPER, chemical engineer of Arthur D. Little, Inc., Chemists and Engineers, Boston, Mass., will act as assistant to Mr. D. T. Randall in the centralized testing department which has recently been organized under Mr. Randall's direction by the above-mentioned concern. Mr. Jumper has had several years' experience in both the chemical and engineering divisions in the company from which he is detailed. This was preceded by service in the testing departments of the Pennsylvania and Union Pacific railroads.

MR. EDWARD E. BACKUS, of Chicago, until recently sales engineer of the United States Electric Company, has been appointed superintendent of telegraph for the El Paso & Southwestern Railroad Company, with headquarters at El Paso, Tex., succeeding Mr. H. W. Cutshall, resigned. Mr. Backus will have direct charge of the operation and maintenance of telegraph and telephone lines and block signals. He is experienced in telegraph and telephone operation, having been connected with the Western Union, American Telephone & Telegraph and New York & New Jersey Telephone companies.

MR. JOHN I. BEGGS is the subject of the following personal tribute from the author in Mr. W. L. Waters' recent book on commercial dynamo design: "For twenty-five years in active touch with the electrical engineering industry, as a manufacturer or as an organizer and operator of public-service corporations, obtaining his engineering and commercial knowledge through hard personal experience, Mr. Beggs was pre-eminently fitted to guide and encourage the youthful engineer. Continually improving and rendering commercially practicable much of the apparatus used in connection with electric lighting or railway interests, and doing this with the purpose of obtaining results, rather than of being accorded credit or public recognition, he was one of the first to realize that the engineer was destined to become the dominant factor in large engineering corporations. Giving his young engineers a free hand in all branches of commercial and engineering work, only guiding and checking them where necessary, he developed organizations and men in a way which, while it made the men his grateful and enthusiastic admirers, established his reputation as one of the foremost organizers in the engineering industry and left his mark on the methods and apparatus of to-day."

Obituary.

MR. LEMUEL R. HOPTON, of the firm of Enos & Company, New York, died at Garrison-on-the-Hudson on Sept. 5, at the age of thirty-seven years. He was a graduate of the Sheffield Scientific School of Yale University and had served as manager of the New York Section of the Illuminating Engineering Society, in which he took a deep interest, having contributed much of value to the discussions relating to artistic electric-lighting fixtures.

MR. OLIN A. STRANAHAN, formerly general sales manager of the Allis-Chalmers Company, died suddenly on Sept. 8 in New York while in a dentist's chair undergoing an operation for an abscessed tooth. The burial took place at Litchfield, Ohio. Mr. Stanahan was connected for five years with the British Westinghouse Company. He joined the Allis-Chalmers Company as manager of the power department and was general sales manager from January, 1905, to November, 1906.

MR. WILLIAM DICKENSON, an electrician employed at the General Electric Works, Lynn, Mass., died in that city, Sept. 11, aged seventy years. He was electrician on the Great Eastern when the first Atlantic cable was laid in 1866. He was born in Hull, England, and has been employed in the pattern department at the Lynn shops for ten years. He is survived by three sons and two daughters. He was a member of the Masonic order in England.

MR. JACOB H. EVANS, secretary of the Edison Electric Illuminating Company of Brooklyn, died suddenly at his Brooklyn home on Sept. 2. The deceased was in the employ of the Brooklyn company for thirteen years, first as auditor and later as secretary. The loss of his wife, a cousin of Mr. A. N. Brady, two years ago was a severe blow to Mr. Evans from which he never recovered. Mr. Evans at the time of his death was also secretary of the Kings County Electric Light & Power Company and secretary and director of the Amsterdam Electric Light, Heat & Power Company. He is survived by three sisters. The interment was at Cincinnati, Ohio, Sept. 5.

Trade Publications.

ELECTRIC GLASSWARE.—The Phoenix Glass Company, New York and Pittsburgh, has issued a leaflet on its new laurel-leaf globes, stalactites, balls and bowls and another on its Sheffield ribbed ball globes. The latter are made with regular curved lip collar to fit any fixture having a standard 3¼ in. holder. The glassware gives a delightful mellow light of strong illuminating value, the manufacturer claiming that very little is absorbed.

MOTOR DRIVE FOR THE PRINTING AND ALLIED TRADES.—Bulletin No. 4869, just issued by the General Electric Company, is an attractive publication devoted to motor drive for the printing and allied trades. The publication illustrates motors and the necessary controllers, for both direct-current and alternating-current circuits, and applicable to job and cylinder presses of all sizes and kinds and to stitching, perforating cutting, numbering, folding and punching machines.

CLOTH PINIONS.—The General Electric Company has just issued Bulletin No. 4878, which is devoted to cloth pinions. This remarkable and somewhat radical form of machine element is offered for a wide variety of applications in mechanical transmission of power where, because of noise or for other reasons, the meshing of metallic pinions with metallic gears is impracticable or undesirable. The advantages claimed for these pinions are great tooth strength, noiseless operation, freedom from damage by exposure to dampness, dryness or temperature changes, elasticity of teeth, self-lubrication and long life. These pinions are made in various styles and sizes, which are illustrated in the publication.

BUSINESS NOTES.

THE WALPOLE RUBBER COMPANY, Walpole, Mass., has added to its present power plant equipment a 750-kw Westinghouse generator set and several boilers, necessitating the erection of a new brick stack 150 ft. high.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., has moved from its long-established location at 2115 Locust Street to the Equitable Building, Suite 507, thus bringing the company into the main business district of St. Louis.

MR. BENJAMIN T. DELAFIELD, who formerly represented the Lunkenheimer Company for a number of years in the St. Louis and Kansas City territory, has become connected with the Best Manufacturing Company, of Pittsburgh, Pa., to handle its line of valves, fittings, flanges, pipe bends, fabricated pipe and other power-plant material in the same territory. He will make his headquarters in Kansas City.

THE GOULDS MANUFACTURING COMPANY, Seneca Falls, N. Y., will open in November a new branch house at Ohio and Franklin Streets, Chicago, Ill., to handle its business in the Middle Western territory, including the States of Indiana, Illinois, Michigan, Wisconsin, Minnesota and Iowa. This house will take over the entire business of the present "Goulds Company," with the exception of its line of centrifugal pumps, and will exploit the new line of volute centrifugal pumps made in its Seneca Falls factory, together with the company's complete line, which includes hand lift pumps, force pumps, windmill pumps of all types, spray pumps, both hand and power, "Triplex" power pumps, rotary pumps, centrifugal pumps, air compressors, vacuum pumps, working heads, etc.—in fact all types of pumping equipment for every service.

INSULATING MATERIAL.—The following communication has been received from the Hemming Manufacturing Company, Garfield, N. J., referring to an item which appeared in this column in the issue of Sept. 2 relating to the use of the trade name "Gummon": "The material manufactured by the Hemming Manufacturing Company under the name of 'Gummon' is the invention of Emil Hemming, being an improvement based on the original invention of Robert Müller. United States Patent No. 869,321, originally granted to Robert Müller, and covering this invention, is now the property of this company, having been purchased from parties in Munich acting on behalf of the orginal owners, the majority of whom were directors of the Isolatoren Werke. The trade mark, 'Gummon,' No. 78,633, has been duly registered by the United States Patent Office and is the exclusive property of this company. The Hemming Manufacturing Company is, therefore, manufacturing only under processes covered by its own patents and exclusive contracts. We must ask that you accord this communication the same publicity as you have given the statement of the Isolatoren Werke."

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 5, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,002,222. TELEPHONE SYSTEM; H. F. Clausen, Chicago, Ill. App. filed July 18, 1903. Common battery; metallic circuit; omits relays in the cord circuits.

1,002,232. ALARM FOR CASH-BOXES; W. E. Dawson and R. McAlpine, Detroit, Mich. App. filed Sept. 11, 1908. For telephone pay stations. An alarm circuit wire is associated with the usual cord. Cutting the cord or tampering with the money box gives an alarm.

1,002,233. ELECTRODYNAMIC BRAKE FOR ALTERNATING-CURRENT MOTORS; W. N. Dickinson, Jr., Brooklyn, N. Y. App. filed Dec. 20, 1905. Elevator system. Alternating-current motor drives direct-current generator and thus supplies direct current to the stator windings of the induction motor.

1,002,238. TELEPHONE ATTACHMENT; G. A. Duryee, New York, N. Y. App. filed May 13, 1908. A yielding mouthpiece within a casing. To permit the use of the transmitter without the voice being audible to a person near by.

1,002,239. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed April 11, 1902. Trunking system with communicating contralized call exchanges.

1,002,240. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed April 11, 1902. The originating operator controls the operation and supervises the entire connection.

1,002,249. ELECTRICAL OXIDATION OF NITROGEN; C. Ellis, Montclair, N. J. App. filed June 6, 1911. A current of oxygen and nitrogen is passed concentrically in a plane at right angles to the normal axis of an elongated arc and the arc is deviated into the path of the gaseous current.

1,002,253. HOT-WATER-BAG HEATER; T. E. Fogalsang and B. McCutcheon, San Francisco, Cal. App. filed Oct. 12, 1910. The stopper carries a naked electrode inside the bag.

1,002,258. APPLIANCE FOR PRODUCING ARTICLES BY ELECTRODEPOSITION; F. I. Gibbs, Birmingham, Eng. App. filed Aug. 16, 1910. A model formed of vitreous material with a metallic deposit-receiving surface burned into the glaze.

1,002,267. MORSE TRANSMITTER; T. Habermann, Hemslingen, Germany. App. filed Jan. 14, 1911. A plurality of series of movable electric contacts representing dots and dashes.

1,002,277. TELEPHONE SYSTEM; A. R. Kahl, Rochester, N. Y. App. filed July 16, 1907. Manual-automatic exchange. Effects by a single operation the closure and subsequent opening of a circuit.

1,002,286. METHOD OF ELECTRIC PRODUCTION OF IRON AND STEEL AND OTHER METALS; A. R. Linblad, Ludvika, Sweden. App. filed March 6, 1909. The terminals of one pole of two phases are connected to one electrode, while the other terminals are connected with the furnace lining.

1,002,336. INDUCTION-MOTOR-CONTROLLING APPARATUS; A. Sundh, Yonkers, N. Y. App. filed Nov. 16, 1905. Elevator system; a mechanical brake connected with the motor.

1,002,348. RAIL-BOND; W. H. Wherry, East Cleveland, Ohio. App. filed June 14, 1905. A continuous strand of conducting material is wound into a coil having superimposed layers, each layer comprising a plurality of turns.

1,002,383. DYNAMO-ELECTRIC MACHINE; V. A. Flynn, London, Eng. App. filed Nov. 29, 1909. Continuous-current generator with magnitude of emf independent of speed and direction of rotation. For train lighting and windmill-operated plants.

1,002,388. METHOD OF AND MEANS FOR CONNECTING TELEPHONE APPARATUS; E. A. Gray, Boston, Mass. App. filed July 30, 1907. The conductors are arranged in groups of divisions in rotation with respect to successive contacts to furnish a maximum service with minimum apparatus.

1,002,390. ANODE FOR X-RAY TUBES; H. Green, Hartford, Conn. App. filed March 28, 1908. A target having a face plate of platinum and a back plate of copper of large mass and high heat conductivity is soldered onto a conducting body.

1,002,444. ELECTRIC-RESISTANCE FURNACE; A. Peterson, Odda, Norway. App. filed May 25, 1910. The charge is forced horizontally inward between the upper and lower electrodes.

1,002,462. SUSPENSION LOOP FOR INITIAL CATHODE SHEETS; E. L. Sibley, Bennington, Vt. App. filed July 29, 1910. The sheet is suspended from a rod by sheet-metal loops having lugs secured in holes in the sheet.

1,002,481. FLEXIBLE CONDUIT; U. S. Armstrong and J. H. Parker, New Kensington, Pa. App. filed June 20, 1910. Non-metallic; for electric wires. Has an intermediate helical layer consisting of alternating coils of flat and round fiber.

1,002,484. CONTROLLING DEVICE FOR ELECTRIC MOTORS; T. Barnard, Toronto, Canada. App filed March 3, 1910. For printing-press control. Solenoids operated by push buttons against gravity for starting.

1,002,527. OIL-COOLED TRANSFORMER; O. Kulka, Hamburg, Germany. App. filed Sept. 21, 1910. The casing has an overflow pipe forming a reservoir to contain an excess of oil and a settling chamber connecting with the pipe.

1,002,533. RESISTANCE BOX; L. A. DeMayo, New York, N. Y. App. filed March 20, 1909. For field and marine engineering, etc. Resistance bars are held by upper and lower plates in a box.

1,002,544. AUTOMATIC CUT-OUT FOR ELECTRIC CIRCUITS; E. S. Sears, Chicago, Ill. App. filed July 25, 1910. Two trolley wires of a double-track railroad are normally fed in series, but can be connected in parallel in case of a break.

1,002,574. CHAIN GUIDE FOR ELECTRICAL PULL-SOCKETS; E. H. Freeman, Trenton, N. J. App. filed June 2, 1911. The "bell" is in two parts, both slotted, and the inner rotatable within the outer to permit the chain to be inserted and removed through the side when the socket cap is off.

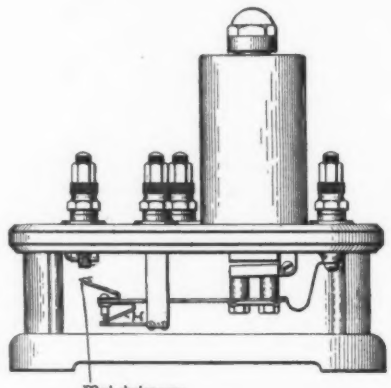
1,002,595. ELECTRIC SWITCH; J. F. McElroy, Albany, N. Y. App. filed Nov. 17, 1910. Blow-out type for electric cars. The switch blades are doubly insulated.

1,002,608. METHOD OF TREATING EMERY ORE; F. T. Tone, Niagara Falls, N. Y. App. filed Nov. 14, 1908. The pulverized ore with enough carbon is heated in an electric furnace to reduce the silica only.

1,002,622. ARC LAMP; J. A. Zeigenfuss, Caney, Kan. App. filed Nov. 18, 1909. Electrically operated mechanical device for holding and guiding the upper carbon and feeding it.

1,002,637. WATER-HEATING APPARATUS; R. Von Brockdorff, Berlin, Germany. App. filed Jan. 5, 1911. An electrode is immersed in the liquid and a non-conducting tube surrounds it and is open above and below to permit circulation of the liquid.

1,002,645. ELECTRODE FOR ARC LAMPS; W. T. Conn, Lakewood, Ohio. App. filed April 1, 1909. Flaming arcs. The main portions are coated with insulating material and a shell of carbon surrounds the insulating coating.



1,002,648.—Relay Contact.

1,002,648. RELAY CONTACT; F. B. Corey, Schenectady, N. Y. App. filed Sept. 3, 1909. The contact is made of malleable molybdenum.

1,002,658. METHOD OF TREATING MOLDS USED IN THE ART OF ELECTROTYPING; G. E. Dunton, New York, N. Y. App. filed Nov. 11, 1910. A grease-converting substance is mixed with black lead and applied to the mold and then the converted substance is washed off.

1,002,687. DYNAMIC-BRAKE CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed Sept. 6, 1907. The motor acts as a generator with a mechanical brake.

1,002,711. SYSTEM FOR THE TRANSMISSION OF ELECTRICAL ENERGY; C. D. Lanning, Boston, Mass. App. filed Aug. 8, 1907. Relayed telephony. Automatically accomplishes the correct circuiting at a repeating point. Partial continuation of application filed April 29, 1901.

1,002,712. ELECTROMAGNETIC DEVICE FOR ALTERNATING CURRENTS; C. D. Lanning, Boston, Mass. App. filed Aug. 2, 1910. Two-way telephone relay.

1,002,713. SELECTIVE SIGNALING SYSTEM; O. M. Leich, Chicago, Ill. App. filed May 3, 1901. Party-line telephone; non-interfering; uses alternating currents of different frequencies.

1,002,718. INDUCTION MOTOR; E. Marelli, Milan, Italy. App. filed Feb. 19, 1909. Single-phase. The field has pole pieces with faces partially concentric and partially eccentric to the armature so as to provide tapered air gaps.

1,002,721. ELECTRIC-ARC FURNACE HEATER; E. A. Mathers, New York, N. Y. App. filed Aug. 9, 1910. An arc and an air blast are directed against material to be welded.

1,002,735. AUTOMATIC TELEGRAPH-KEY CLOSER; D. E. Motz and F. B. Hatfield, La Jara, Col. App. filed Oct. 4, 1910. Self-closing key with the switch arm above.

1,002,755. TROLLEY PLACER; W. D. Reist, Williamsville, N. Y. App. filed Aug. 26, 1910. Detail combination of wheel, bearings and diverging arms.

1,002,758. CONTACT FOR ELECTRIC-WELDING MACHINES; A. F. Reitzel, Charlestown, R. I. App. filed Aug. 25, 1908. For attaching spouts to kettles, etc. Contacts normally free from the electrodes engage the work around the place to be welded.

1,002,766. CONTROLLER FOR ELECTRIC MOTORS; A. W. Schramm and E. B. Wilford, Riverton, N. J., and Merion, Pa. App. filed July 10, 1911. Foot controller such as used by dentists for governing the operations of a dental engine, etc.

1,002,778. TAXIMETER CONTROL; J. D. Sulsona, New York, N. Y. App. filed Dec. 29, 1909. An alarm sounds while a passenger is entering the cab and until the controlling flag is thrown for recording.

1,002,803. COMPOSITE TELEGRAPH AND TELEPHONE SYSTEM; C. L. Bopp, Meers, S. D. App. filed Oct. 17, 1907. Metallic telephone circuit and ground return for the telegraph with phantom circuits.